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INTERNATIONAL RAILWAY CONGRESS
ASSOCIATION
(ENGLISH EDITION)

INTERNATIONAL RAILWAY CONGRESS ASSOCIATION

14th. SESSION (LUCERNE, 1947).

QUESTION IV.

The interest the Railway Administrations would have in building houses for the staff of all ranks, or in assisting the building of such houses,

(including policy and pratice of Railway Administrations in connection therewith and advantages derived therefrom).

REPORT (*)

(America, Great Britain, India, Dominions, Protectorates and Colonies, China and Egypt),

by A. P. J. BALL,
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PART I.

A questionnaire, to be answered by all Railway Administrations, was agreed with M. Edoardo Antonucci, Inspecteur en Chef du Service du Personnel et des Affaires Générales, Ferrovie dello Stato, Rome, the reporter on this subject for the other countries, and was sent to 45 Railway Administrations in the countries named above. Replies have been received from the following :

Great Western Railway.
London Midland & Scottish Railway.
London & North Eastern Railway.
Southern Railway.
London Passenger Transport Board.
Cheshire Lines Committee.
Great Central & Midland Joint Committee.
Midland & Great Northern Joint Committee.
} British Railways.

(*) *The present report has been based on the replies received to the questionnaire addressed to all affiliated Railways but several were unable to assemble and despatch the desired information in time for inclusion. Any replies which come to hand later will be published as a supplement to this report.*

Iraqi State Railways.
New Zealand Government Railways.
South African Railways and Harbours.
Sudan Railways.
Buenos Aires Great Southern Railway.
Buenos Aires and Pacific Railway.
Buenos Aires Western Railway.
Central Argentine Railway. — Argentine.
Baltimore and Ohio Railroad.
Bessemer and Lake Erie Railroad. — United States of America.
North Western Railway.
South Indian Railway.
Great Indian Peninsula Railway. — India.

QUESTION (1). — *What is the present policy and practice of the Railway Administrations in regard to the provision of housing accommodation for their staff or assisting in provision of such housing accommodation ?*

BRITISH RAILWAYS. — There are no general schemes for the provision of further housing accommodation for the staff. Where existing railway houses have been occupied by non-railwaymen and become vacant, the opportunity is taken to house a railway employee. Large properties, where suitable, are converted into flats or maisonettes. In certain exceptional cases where staff in key positions, such as Divisional and District Officers, Station Masters, Inspectors, etc., have been transferred and are required to reside near the place of their appointment, houses are being acquired and let to these employees.

IRAQI. — To provide accommodation for all staff necessary to operate railway.

NEW ZEALAND. — To provide houses in localities where housing shortage is particularly acute, and where it is to the advantage of operating staff, such as at country stations.

SOUTH AFRICA. — To provide housing accommodation for « free quarters » staff, such as Gangers and Station Foremen, and erect houses to let to staff who must live close to their work, or where private accommodation cannot be obtained. Also to assist employees by means of a rent rebate scheme, whereby employees occupying rented houses at rents in excess of one-fifth of their substantive emoluments are entitled to apply for rent rebate, subject to a maximum of £ 4 per month.

SUDAN. — Unfurnished quarters are rented to British officials and certain Sudanese and others where essential to live close to their work. Also quarters are provided in towns for general use of staff and at wayside or desert stations.

ARGENTINE. — Only to provide houses when service reasons oblige Administration to do so on account of local conditions.

UNITED STATES (BALTIMORE & OHIO RAILROAD AND BESSEMER & LAKE ERIE RAILROAD). — These Administrations do not provide or assist in the provision of housing accommodation for employees.

(PENNSYLVANIA RAILROAD AND LONG ISLAND RAILROAD). — Housing accommodation is not provided apart from very exceptional cases.

INDIA. — To provide housing accommodation mainly for staff required to live close to their work, i.e., safety and operating staff. In addition, a certain number of quarters are provided for other staff at large centres; at wayside and village stations, where private housing is not available; accommodation may be provided for all staff. The policy with regard to the housing of staff, including extent to which the Railways, both as large scale employers and semi-government commercial undertakings, should cater for the housing of their staff has recently been investigated by a Housing Committee appointed by the Railway Board, and as a result of their investigations it is likely that additional grades will be provided for in the construction of houses.

QUESTION (2). — (a) *Is there any existing scheme for providing houses for all classes of employees or for particular grades? Please give details.* (b) *Is it the practice to purchase or build houses for transferred staff who are without a house at their new place of work?* (c) *Is there any existing scheme for assisting in the construction of houses and flats for letting to railway employees, e.g., through building associations? Please give particulars.*

BRITISH RAILWAYS. — (*a*) There are no schemes for the provision by the Undertakings of houses for all classes of employees or for particular grades, but many existing houses are earmarked for particular posts, such as Station Masters, Level Crossing Keepers, etc.

(*b*) Only in the case of certain staff in key positions who would otherwise be unable to find accommodation in the locality of their appointment.

(*c*) In 1923, the Great Western Railway Company formulated a scheme for providing houses to let to their employees at certain centres where the housing position was difficult. A number of estates were laid out on land acquired by the Company, upon which roads and sewers were constructed, and a lease of the site granted to Associations of employees formed and registered under the Industrial & Provident Societies Acts. An appropriate ground rent, having regard to the expenditure incurred by the Company on land, roads, etc., was charged and the Association arranged a contract for the erection of the houses. The Company advanced 90 % of the cost of the buildings by way of mortgage at 4 % per annum, the total being repayable in 100 equal instalments over a period of 50 years. The remaining 10 % formed the capital of the Association, which was subscribed by employees desirous of becoming tenants on the estate. The estate is managed by an elected Committee of tenant members, who arrange the tenancies of the houses and the maintenance of the houses and the estates generally. Under this scheme 1 646 houses were erected at 8 centres, the largest number being 1 059 dwellings, comprising two estates in the London suburban area.

IRAQI. — (*a*) For all operational staff.

(*b*) Not necessary because of (*a*).

(*c*) No.

NEW ZEALAND. — (*a*) Where houses are scarce — not restricted to any particular grade.

(*b*) Yes, to purchase and build.

(*c*) No.

SOUTH AFRICA. — (*a*) Yes. — Annual programme of house construction.

(*b*) No. — Transferred staff who are entitled to free quarters occupy houses vacated by their predecessors. Otherwise staff await allocation of house for renting.

(*c*) No.

SUDAN. — (*a*) Only supervisory or executive grades and certain other em-

ployees according to demand and local circumstances.

(*b*) Sometimes necessary to build houses for transferred staff.

(*c*) No.

ARGENTINE. — (*a*) No, except as in (*b*).

(*b*) where local conditions make this necessary.

(*c*) No.

INDIA. — (*a*) No scheme for all grades, but for essential grades (safety and running staff), and other grades in certain circumstances. In the post-war period, it is anticipated that more grades will be included in the term « essential » for this purpose.

(*b*) It is not the practice to purchase or build houses for transferred staff who are without houses at their new places of work, but re-allotment of quarters is made where possible, or in lieu thereof, house rent allowance may be made, if eligible. In the case of some essential staff, however, quarters were made available by requisitioning accommodation under the Defense of India Rules, the building rented being treated as a railway house or as a house privately rented by the staff with the assistance of the railway. In some cases, for similar reasons, staff have also been permitted to retain houses at their old stations so as to accommodate their families and prevent hardship.

(*c*) No.

QUESTION (3). — *Give reasons or motives which have induced the Railway Administration to provide housing accommodation for their staff or assist in such provision.*

BRITISH RAILWAYS. — To enable staff to live in proximity to their place of employment, exigencies of railway service during its development through the years having resulted in the location of staff in varying numbers at places where housing accommodation has not been available.

IRAQI. — To secure efficient operation of railway, and where high rents for private houses prevail.

NEW ZEALAND. — Without adequate housing in the right place staff requirements would not be met in certain localities.

SOUTH AFRICA AND SUDAN. — To enable servants to be comfortably housed; also to meet exigencies of service and railway requirements at centres where private enterprise is more or less non-existent.

ARGENTINE. — Scarcity and needs of service.

INDIA. — The need for certain staff living where the requirements of the service demand and being readily available for call in emergencies; also to provide accommodation at stations where sufficient housing by private enterprise was not obtainable, so as to relieve the staff of any discomfort, hardship and consequent discontent as regards the conditions of their service and thus induce efficiency of working.

QUESTION (4). — *Organisation and working of the Department responsible for the building, upkeep and management of staff housing accommodation, and for the working out and putting into effect of measures for encouraging such construction.*

BRITISH RAILWAYS. — The management and maintenance is the responsibility of the Administrations' Estate Departments. Actual maintenance work generally is carried out by local contractors and rents deducted through paybills. With regard to the houses comprising the estates on the Great Western system, referred to in 2 (*c*),

these are maintained by permanent employees under the supervision of Estate Foremen, who are controlled by the Management Committees. To ensure uniformity of practice and provide technical and administrative services, the Welsh Town Planning & Housing Trust Ltd., — a Company specifically formed for the purpose of developing and managing housing estates — acts for the Great Western Railway Company and the Housing Associations.

IRAQI. — Directorate is responsible for policy and Chief Engineer's Department for construction and maintenance. No Estate Office.

NEW ZEALAND. — Housing maintenance forms part of ordinary duties of Maintenance Branch.

SOUTH AFRICA. — Funds, approved annually by Parliament through Railway Budget, are allocated by General Manager to the nine railway systems. After obtaining sanction for work from the General Manager, the System Manager arranges acquisition of material through Stores Department and directs the carrying out of the work through the Engineer.

SUDAN. — Annual programmes for additional quarters approved by General Manager, on the recommendation of Building Committee, which includes Heads of all Railway Departments. Proposals submitted by Departments individually and by Establishment Officer, who correlates demands received from Housing Committees set up at large centres as well as from Departments.

ARGENTINE. — Upkeep by Way & Works Department. Houses allocated and rents collected by Department to which they belong for service reasons.

INDIA. — Each year the position is reviewed and quarters provided according to funds allocated. Type, number and locations decided by General Manager in conference with Heads of Departments. After estimates sanctioned, work done by contractors, supervised by engineering department. Quarters are allocated to various departments who control allotment to staff.

QUESTION (5). — *Please give a brief history of past house building by the Railway Administration and provide statistical information, columns (a), (b) and (c) below :*

BRITISH RAILWAYS. — In the earlier days, numbers of houses were constructed at centres where extensive railway depots or works were established. Small terraces of houses were also constructed adjoining a number of stations for permanent way and operating staff. Single houses were provided for crossing keepers and station masters, the latter often being accommodated in residential portion of station buildings. When Railway Companies demolished residential buildings in order to carry out railway works, if more than a specific number of persons (usually 30) were affected, the Railway Company were required to build alternative dwellings. Wherever possible these have been let to railway staff.

IRAQI. — For operational staff.

NEW ZEALAND. — Architectural Branch was formed in 1920 and embarked on factory cut houses. Altogether 1 380 were built under this scheme.

SOUTH AFRICA. — Up to March, 1938, 12 312 had been erected for use of European staff, and since that date the number has been progressively increased to the extent of 1 749 houses.

SUDAN. — Accommodation for officials and staff to live close to work. Also for general use of staff in towns and at wayside or desert stations.

ARGENTINE. — Houses were built by Administration at points where service reasons obliged staff to reside and no other accommodation was available.

INDIA. — Accommodation constructed for essential staff; also other staff in large centres and at wayside stations and villages where private houses are scarce.

	(*a*) *Total number of staff of all ranks employed by railway administration.*	(*b*) *Proportion of staff who are householders or would be householders if sufficient housing accommodation was available.*	(*c*) *Total number of houses and flats owned by Railway Administration occupied by present employees.*
British Railways	718 569	Not available.	32 562 (In addition, there are many railway-owned houses occupied by non-railway servants.)
Iraqi	13 950	100 %	2 722
New Zealand	18 000 permanent staff.	Not available.	3 978
South Africa	118 236 permanent and temporary (including 65 996 graded European staff and 12 521 railworkers). 46 228 casual (including 6 534 graded European staff and 6 228 railworkers).	Not available.	14 061
Sudan	20 000	Not available.	4 250 exclusive of barracks provided for men only.
Argentine	100 000 (by foreign capital companies).	Not available.	Not given.
United states :			
Baltimore & Ohio Railroad Company.	59 000	Not given.	Nil.
Bessemer & Lake Erie Railroad Company.	Not given.	Not given.	Nil.
Pennsylvania Railroad.	Not given.	Not given.	Exceptional cases only.
Long Island Railroad	Not given.	Not given.	Exceptional cases only.
India :			
North Western Railway.	102 257	Not available.	56 208
South India Railway.	48 589	About 50 %	11 435
Great Indian Peninsula Railway.	135 194	Not available.	27 533

QUESTION (6). — *Give information as to type of accommodation provided, e.g. groups of houses, whether terrace, semi-detached or detached; large or small blocks of flats; also particulars as to number of rooms — bedrooms, living rooms, kitchen, bathrooms, etc. and outside accommodation.*

BRITISH RAILWAY. — Detached, semi-detached or terrace, as the particular need required. Mainly 3 bedrooms, 2 reception rooms and usual offices, all modern constructions having bathrooms. Flats are being provided in some instances, usually by conversion of large houses.

IRAQI. — Normally, detached and semi-detached single storey houses. The average house has 3 living rooms, kitchen, bathroom and « built-in » cupboard.

NEW ZEALAND. — Mainly 5 roomed houses of 1 000 feet, exclusive of pantry and bathroom. Washhouse, with access from outside door. Lavatory and coal-shed detached. Detached residences, many in close proximity to station yards. Majority in settlements where areas of land have been purchased for erecting houses — this applies mostly in large towns.

SOUTH AFRICA AND SUDAN. — Several types of house or dwelling, dependent on grade of official or employee. Typical house for more senior grades : Verandahs, living room, dining room, 3 bedrooms, bathroom, kitchen, pantry, lavatory (water closet where possible) outside fuel store, garage, also one or two rooms for servants, with lavatory. For medium grades : Dining room and garage may be excluded, and in the case of lower grades there are no servants' rooms. As a general rule, each house has its own garden, and in South Africa no terrace houses are now being erected; flats are only considered where space is limited. Provision is made for non-Europeans, from three roomed dwellings, with bathroom and lavatory, down to single roomed building (in Sudan) with kitchen, etc.

ARGENTINE. — In a few places colonies were constructed, being mostly semi-detached houses of two, three or four rooms, bathroom, kitchen and garden.

INDIA. — The type of accommodation varies from one room tenements in blocks of 8 to 10 to detached independent bungalows, with 4 or 5 main rooms, depending on the status and the scale of pay of the employee. Except in large cities, flats have not been built. For subordinates the quarters are semi-detached insofar as two units are combined, each with a small independent compound. The existing scale of accommodation varies from one living room, one bedroom, store, pantry, kitchen, bath, etc., to one living room and two bedrooms, with ancillary accommodation. For senior subordinates, like Foremen and Inspectors, usually four rooms, consisting of a drawing room, dining room and two bedrooms, with ancillary accommodation, and servants rooms are provided. The accommodation provided for officers is on a more superior basis; a typical medium house comprises 3 bed and 2 dressing rooms; two or three reception rooms; office; kitchen; two bathrooms; conveniences and ancillary rooms. Garage and grounds, also servants quarters.

QUESTION (7). — *Give financial terms and conditions in connection with the provision of housing accommodation; average cost per unit (house or room, etc.) or on a cubic basis according to floor, locality, and for each type of building. Give rules adopted for fixing rents and comparison of these rents with those charged by private individuals.*

BRITISH RAILWAYS. — Varying conditions make impossible to furnish any useful information as to cost of providing accommodation. Generally, houses were let at local values, but owing to the operation of the Rent Restriction Acts these rents are lower than those prevailing in respect of comparable modern houses. The Great Western housing schemes have been financed on a 4 % basis, but a lower figure may be applied to future development.

IRAQI. — Average present day cost is £1. 4s. 0d. per square foot of single storey house. Rent is fixed at 1 % of capital value of house.

NEW ZEALAND. — Rents are fixed on basis of floor space and locality. Private individuals' houses are approximately £1 per week daerer than Railway rents.

SOUTH AFRICA. — Average cost per cubic foot : European housing 1s. 7d., non-European 1s. 5d. Rents based on square footage : 1d. per sq. ft. for brick etc. buildings and .8d. for wood and iron, subject to maximum of 1/6th. of salary. Non-European houses : 2s. 6d. per living room, plus 1s. 0d. for each additional facility, such as water, stove, etc. These rents are considerably less then privately let houses.

SUDAN. — All employees receiving more than £2 (Egyptian) per month pay rent, but 7 ½ % of basic pay is maximum, unless employees desire quarters larger than normally entitled. Approximate present day average cost of residences : £2 500 (3 bedrooms, sitting and dining rooms, bathroom, kitchen, conveniences. One or two servants' rooms. Verandahs, garden and garage) for Senior Officials. £ 1 500 (smaller houses with two bedrooms, sitting and dining rooms, bathroom, kitchen, running water, closet, servant's room, verandah, small garden) for fairly senior non-Europeans. Smaller houses : £ 700 and £ 450, down to £ 220 for double and £ 120 for single roomed lowest type. Rents based on a formula, which takes into account : Areas of living rooms, service rooms, verandah and garden, type of roofing and windows and general finish. Rents are not calculated on an economic basis, but are standardised for each type throughout system. These rents are at present lower than privately let house rents.

ARGENTINE. — Each system has established its own basis for rent. One is based on floor area, irrespective of locality, subject to reduction where out of line with private house rents. Generally speaking, railway rents are lower.

INDIA. — The assessed rent is 4 % of the « pooled » capital booked cost of each type of house or quarters, excluding the cost of land, but including fittings, like water, electricity, etc. Some categories of staff have, in the past, been permitted rent free accommodation, and staff getting less than Rs. 30 per month have always been given rent free accommodation. Also certain lower paid categories are charged rent on a basis considerably lower than 4 %. Generally in big cities and towns the rents charged by the Railway are lower than those charged by private owners for similar accommodation, but in villages and at wayside stations the rents are higher, mainly because the standard of accommodation is superior. The recovery of rent is, however, limited to the extent of 10 % of an employee's salary, the cost of electric current and a flat rate on account of the supply of water are charged for as extras.

QUESTION (8). — *State financial repercussions of this housing construction and its management on the budget of the Railway Administration.*

BRITISH RAILWAYS. — Generally speaking, the provision of houses has no

appreciable bearing upon the financial accounts of the Railway Administration, although it should be noted that the rent obtained overall does not adequately meet the cost of repair, depreciation and interest on the capital employed.

IRAQI. — Building programmes framed with due regard to extent of funds available and when of any magnitude, cost is met out of accumulated surplus revenues of the Administration.

NEW ZEALAND. — Departmental dwelling statement shews loss of £112 732 for the year ended 31-3-1946, but this does not give full picture of financial repercussions. If dwellings were not provided, the expense of providing temporary accommodation for members on transfer would be out of all proportion and would quickly become greater than loss shewn by the statement.

SOUTH AFRICA. — No financial repercussions — money required for erection of houses is voted each year as part of amount necessary during course of the year for capital works.

SUDAN. — Total capital cost of all housing accommodation provided up to 1945 was £733 000. Annual rent collected £18 700. Maintenance cost, £30 000 per annum out of total annual railway expenditure of £3 000 000. Full rent of all quarters amounts to £26 900.

ARGENTINE. — Programme completed many years ago; no new construction worthy of mention for several years.

INDIA. — The construction of housing by the railways has failed to realise a minimum of 4 % return on the capital cost which was adopted as the target figure. In view, however, of its effect on the efficiency of the staff and the responsibilities of the railways as a large scale Government employer of labour, the revision of this basis and the fixing of a lower target for return on the capital cost is under investigation. On the whole it can be said that housing by the railways will not provide the out-of-pocket expenses on maintenance and the interest on the capital invested, particularly because the present tendency is towards better conditions of living for the working classes.

QUESTION (9). — *Has the accommodation constructed up to now achieved the objects which the Railway Administration had in view? Give particulars of any programme of new building, including characteristics of the types of houses proposed to be adopted, and rules to be followed for grouping of accommodation and utilisation of open space.*

BRITISH RAILWAYS. — In a general way it is probably true to say that the objects in view of the Railway Administrations have been achieved from time to time, but housing shortage, caused by periods of national emergency such as the recent world war, has created fresh problems as regards accommodation for railway employees, also accentuating difficulties in obtaining vacant possession from retiring staff and widows of deceased employees. Generally, the Companies have not formulated any programme for the building of further houses; but the Great Western Company are endeavouring to foster the extension of the railway estates on their system.

IRAQI. — Yes.

NEW ZEALAND. — Yes, but still inadequate.

SOUTH AFRICA. — Yes, but not to full extent. Annual programme will continue until adequate housing provided. Estimated 10 years to reach ideal state. Houses situated in townships or along railway; therefore, only few instances where comprehensive planning can be

undertaken, but wherever possible suitable grouping, orientation, etc. and open spaces are planned, and attention is paid to grouping of living, ablution and sleeping accommodation in houses.

SUDAN. — Yes, to substantial extent. There has been some lag during war, but whilst staff housing presents day to day difficulties, this is not a major problem.

ARGENTINE. — Yes, originally, but in certain cases men have preferred to live in towns which sprang up later, abandoning houses erected for service reasons. Any new building would only be contemplated if service reasons warranted such construction.

INDIA. — It can be said that the accommodation provided up to now has, on the whole, achieved the objects which the Administrations had in view, although it is realised that further accommodation is required. Steps are being taken accordingly in post-war schemes — please see earlier replies re appointment of Housing Committee by Railway Board. It is intended to make more liberal accommodation for lower paid staff, including modern amenities (North Western Railway state 5 211 additional quarters included by them in 5-year Rehabilitation & Development programme). Accepted principles of town planning with parks and playgrounds, etc., are included in larger schemes.

QUESTION (10). — *As regards existing staff housing accommodation : (a) Are staff allowed to remain in occupation after retiral ? (b) Are widows and families of deceased railwaymen-tenants allowed to remain in occupation ? (c) If answer to questions (a) and (b) is « Yes », what is the method of providing houses for the successors to the retiring and deceased members of the staff ?*

BRITISH RAILWAYS. — (*a*) If the house is required by a railwayman still in the service, then the retiring member of the staff is requested to give possession, but owing to the present acute housing shortage and the difficulties which can arise under the Rent Restriction Acts, it is not always found possible to secure possession.

(*b*) The same position arises in regard to widows.

(*c*) If it is essential for alternative accommodation to be provided, then the Companies have no alternative but to acquire premises if they fail to secure possession of the property previously held for the purpose.

OTHER COUNTRIES. — In general, Railway houses are only let to staff in active railway service, and the answer to (*a*) and (*b*) is in the negative, but a short period of grace is usually allowed in exceptional cases.

QUESTION (11). — *Give particulars of any scheme for modernising old railway-owned houses.*

BRITISH RAILWAYS. — The question of improvement of accommodation occupied by staff has been taken in hand. With a view to making good where possible the lack of amenities now regarded as normal in houses in this country. such as bathrooms and indoor sanitation, hot water and such services as electricity, gas and water, a start was made with houses occupied by station masters and crossing keepers. Many station houses and crossing cottages are situated at wayside places where such service as main water and electricity are only now becoming available, and full advantage is being taken of these facilities in drawing up improvement schemes. Building restrictions and shortage of materials consequent upon the war emergency are having the effect of slowing down this modernisation

work, for the time being at any rate, but plans are proceeding in the hope that the actual work will be accelerated in due course.

IRAQI. — No scheme.

NEW ZEALAND. — Provision of hot water services, electric lighting, connecting with water supply and sewers, also installation of septic tanks — where services previously non-existent.

SOUTH AFRICA. — Wherever possible, old types of houses are modernised by the addition of bedroom, kitchen, bathroom, etc., in order to bring the accommodation up to the standard of modern type houses.

SUDAN. — No scheme. Comparatively small annual allocation for minor improvements.

ARGENTINE. — No scheme. Property kept in good state of repair and modernisation would be limited to advance in local sanitary conditions.

INDIA. — No scheme yet for houses, but the post-War Development & Rehabilitation Programme envisages considerable improvement to lower grade quarters. The following amenities are being provided : individual water supply; trellis to verandahs; individual lavatories, flushed where possible; changing type of roof to suit modern conditions; provision of modern flooring; addition of courtyards, sinks and bathrooms.

QUESTION (12). — (a) *Would it be considered an advantage to the Railway Administration if they provided a house for every member of their staff?* (b) *If so, what arguments are submitted in favour and what advantages would accrue to the Railway Administration ?*

BRITISH RAILWAYS. — No. Apart from the fact that it would not be practicable owing to the very large numbers of staff involved, there is under normal conditions the inherent desire on the part of the individual to choose his own dwelling.

IRAQI. — (*a*) Yes.

(*b*) The more efficient working of the line and economy in cost of operation.

NEW ZEALAND. — Undoubtedly this facilitates staff changes and adds to mobility of staff.

SOUTH AFRICA. — (*a*) No.

SUDAN. — (*a*) If houses were provided for all railway staff they would, in many cases, sublet, as apart from those who own and wish to live in their own houses, or with relatives, others prefer to live away from stations. At the present time there are waiting lists at large stations, but experience in the past has shewn a fluctuation in demand, which is high when money is plentiful and market rents are high, but during trade depressions, market rents drop below fixed Government or Railway rents, and demand for quarters owned by Railway falls away.

(*b*) None.

ARGENTINE. — (*a*) No, and personnel prefer to elect their own place of domicile.

INDIA. — (*a*) Although the South Indian Railway would be inclined to favour a scheme for the provision of houses for all staff except those who wish to live in native villages, the other two Railways would not consider a housing scheme for all staff to be an advantage, and this might be unpopular, except where private accommodation is scarce. Some employees prefer to live in private quarters for personal reasons, such as proximity to schools, entertainment centres, etc. If full housing was provided it follows that staff would have to be compelled to live in railway colonies, and the financial loss to Admi-

nistration would be heavy on account of limitation of rent at 10 % of pay. Advantages would be : availability of staff, comradeship among them, and their children would grow up in railway atmosphere, perhaps acquiring bent and practical ability for railway work; also staff would be better looked after as regards health and medical attendance.

(*b*) Extra burden would more than outweigh advantages.

QUESTION (13). — (a) *Do any schemes exist under which the Railway Administration assist their employees in purchasing houses for their own occupation ?*

(b) *If so, please give full particulars of financial arrangements (i.e., interest rates, percentage of loan, etc.), together with general and statistical information as to the extent members of the staff have taken advantage of such schemes.*

(c) *Could it be said that such schemes meet all reasonable requirements, and to what extent would they affect a general scheme for the provision of railway-owned houses for all members of the staff ?*

(d) *Could it be argued that the purchase by an employee of a house for his own occupation discourages him from accepting promotion involving his transfer to another place ?*

BRITISH RAILWAYS. — The Great Western Railway and Southern Railway operate staff housing loan schemes, with an interest rate of 4 % per annum, for periods up to 20 years, dependent upon age of applicant, repayments are made through paybills. The G. W. Railway lend up to 90 % of their Surveyor's valuation, with loans up to date totalling £1 445 000, out of which £1 334 000 has been repaid. 3 500 loans have been made, with 2 300 redemptions. 80 % is normally advanced by the Southern Railway, but in special cases as much as 100 % of valuation. Advances to end of 1945 total £386 600, and repayments £324 600; number of loans — 786, and redemptions — 513. A life insurance scheme operates in conjunction with this loan scheme. The London Midland & Scottish Railway and the London & North Eastern Railway each have arrangements with well known Building Societies for housing loans to railway staff, on similar lines to the above, repayments being deducted through paybills. In certain cases, the L. M. S. Railway give a guarantee in order that the applicant may obtain a loan higher than the normal maximum. Since the inauguration of the L. M. S. Building Society Scheme in 1934, L. M. S. employees have obtained 815 loans, totalling £461 200. Prior to this arrangement the L. M. S. Railway itself operated a staff housing loan scheme, which closed in 1934 with a total loan figure of £2 019 577, representing 3 907 loans. The schemes are not intended to meet all housing requirements of the railway staff, as there are many thousands of railwaymen reasonably comfortably accommodated in houses which have been let to them by the Local Authorities or private owners, and from which, under existing legislation, they cannot easily be displaced. It is considered that existing schemes meet all reasonable requirements, and as earlier mentioned, a scheme for providing railway-owned houses for all members of the staff is not practicable. There is no evidence that the purchase of a house by an employee deters him from accepting promotion.

IRAQI. — (*a*) No.

(*d*) Yes.

NEW ZEALAND. — (*a*) No.

(*c*) No; would not add to mobility of staff.

(*d*) This is definitely the case, as in-

stances arise where employees owning houses have declined promotion rather than transfer.

SOUTH AFRICA. — Yes. House Ownership Scheme. Interest 3 ½ % on loans granted prior to April 1943, reduced to 3 % for loans after that date. Loan is to full value of house as assessed by Administration's Valuer. All properties registered in name of Administration until loan fully liquidated. Period of loans normally dependent on applicant's statutory retiring age. To meet the case of older servants, period of redemption may extend 10 years beyond retiring age, but employee must repay balance on retiral from Pension Fund annuity, or by raising bond or making cash payment. Maximum loan permissible is amount upon which total repayment, inclusive of insurance and rates and taxes will not exceed 35 % of applicant's basic pay, excluding overtime, etc. Scheme is now open to temporary staff, as well as permanent staff, providing they have five years pension contributing service. A popular aspect of the scheme is insurance against death of employee to cover outstanding loan. Also Storm and Fire Insurance at 6 d. per cent per annum for each risk. Repayments are made monthly through paysheets and include not only capital and interest, but a monthly charge in respect of rates and taxes. Houses erected under Scheme are supervised by Valuators attached to System Housing Board. Up to March, 1946, 2 258 loans have been made (including 498 houses constructed), totalling £2 672 057. It cannot be said that the above scheme meets all reasonable requirements of staff, as the maximum loan for lower paid staff was found to be insufficient. Consequently, the Administration modified main scheme by granting loans at 1 ¼ % interest and Administration pays lump sum life insurance; moreover, applicant may redeem only portion of loan up to date of retiral, paying balance on retirement. These conditions apply to servants earning not more than 11s. 5d. per day (or £16. 15s. 0d. per month). In case of servants earning from 11s. 6d. to 14s. 6d. per day (£21. 5s. 0d. per month) the normal rate of interest applies, but single insurance premium is paid by Administration. It is not possible to say whether the purchase of house reduces the willingness of staff to transfer for promotion, but certain safeguards are introduced, such as letting house on the borrower's behalf to another employee by Administration, or failing this, house may be let to member of public. If employee does not wish to retain ownership he can take advantage of certain conditions of loan for cancellation of the agreement, in which case Administration will negotiate sale to another servant. Such arrangements have so far ensured that the scheme has not affected fluidity of the service.

SUDAN. — Yes. Housing Loans are granted to pensionable officials and employees in Provident Fund. Interest 2 % per annum. Repayments monthly through paybills. Loans equivalent to 9 months' salary, 12 months' salary or 24 months' salary, according to pensionable, etc. service, and in certain cases up to 30 months' salary. This loan scheme has been reintroduced recently and its effects on demand for railway-owned houses cannot be measured. In a limited way the ownership of houses may affect fluidity of staff.

ARGENTINE. — No Loan Scheme, but there is a National Law, combined with Pension Fund Law for Railwaymen, providing for such loans. The interest rate is 4 %, including life insurance. The Administration is not concerned except insofar as they collect through paybills the contributions as Agents. Up to 1945, 17 650 have availed themselves of loans under Pension Law since its inception in 1924. Trouble has arisen from time

to time where property owner is concerned in service transfer governed by labour agreements. Sometimes arrangements made with Trade Union to transfer another man. In exceptional cases Pension Fund Board authorise sale of houses.

UNITED STATES OF AMERICA (2 RAILWAYS). — No staff housing loan scheme, but one Administration formerly lent money at current rate of interest.

INDIA. — No, except that the North Western Railway Co-operative Credit Society, under Railway patronage, advance loans to staff on a small scale. The purchase of a house by an employee tends to discourage him from accepting a transfer and in some cases, promotion.

QUESTION (14). — *Are there any Government and municipal housing schemes, and do railway employees obtain any special allocation ?*

BRITISH RAILWAYS. — There are no Government housing schemes, but the policy of the present Government is to arrange for all needs to be met by the provision of houses by local authorities with State aid at the present time. Railway employees do not obtain any special allocation, their applications for houses being considered on their merits in conjunction with all other members of the community. In practice railwaymen are to an extent penalised, as in the main they are men transferred from another locality, and they consequently lose any priority they would otherwise have had owing to their short residence in the local authority's area.

IRAQI. — No.

NEW ZEALAND and SOUTH AFRICA. — Yes, both types. No preference to railway employees.

SUDAN. — Railway servants are excluded from other Government schemes.

ARGENTINE. — Very little done and no special allocation to railwaymen.

INDIA. — So far no such scheme, but Provisional Government are considering.

QUESTION (15). — *What is the present position as to housing accommodation generally ? Is there a shortage ? Please give a description of the steps which are being taken to remedy any shortage. Is it appreciated that conditions vary considerably from one country to another, and an indication as to special difficulties would be helpful.*

BRITISH RAILWAYS. — There is a definite shortage, the remedying of which is a national problem, which has been delegated to the Local Authorities.

IRAQI. — There is a shortage. Building is being undertaken as material becomes available.

NEW ZEALAND. — Yes, acute shortage. Government State Housing Scheme. Railways Department has scheme to erect 100 each year for some years to come.

SOUTH AFRICA. — Yes, acute shortage, gradually being remedied by the Government through National Housing Scheme and by Municipal Housing Schemes, also private enterprise. Skilled labour and building materials in very short supply.

SUDAN. — There is a shortage which is being catered for as conditions permit.

ARGENTINE. — Housing shortage in large towns. This is a Government matter.

INDIA. — As a result of the war the present situation is generally extremely unsatisfactory. Acute shortage in large centres and no corresponding building activity by private enterprise.

QUESTION (16). — *Is there any legislation or Government control affecting the construction or tenancy of houses ? Do tenants enjoy any general protection from eviction and, if so, is the Railway Administration exempted in any way from such legislation by reason of the necessity for housing members of their staff ? A general reply on this aspect is desired. Does the Railway Administration enjoy any tax exemption ?*

BRITISH RAILWAYS. — All building of houses is controlled by making it necessary to secure licences from local authorities, who are subject to regulations laid down by the central Government. Local Authorities prepare schemes to meet the housing needs in their localities, such schemes being subject to the approval of the Government. In regard to occupation, the tenancy of most occupiers is protected by legislation, and it is only in very exceptional circumstances that eviction will be resorted to. There is no special protection for railway employees nor do the Railway Administration enjoy any tax exemption.

IRAQI. — Under war-time legislation tenants are protected against eviction, but not applicable where houses are property of Government and required to meet their needs. Administration exempt from Property Tax as premises are property of State.

NEW ZEALAND. — Yes, building by permit only. Fair Rents Act, 1936 (and Amendments) precludes Department evicting certain persons. In order to obtain possession it is necessary to provide alternative accommodation, or establish hardship to proposed tenant greater than person to be dispossessed. Not exempt from this law. No land tax is paid by Department.

SOUTH AFRICA. — Yes, both with regard to construction and tenancy. Tenants at present enjoy, in certain instances, protection from eviction. Houses erected by Administration on its own land are not subject to legislation or government control and are exempt from taxation.

SUDAN. — Yes, there are building regulations. Houses, which are Railway property are, with a strictly limited number of exceptions, occupied only by serving railway staff. Eviction only by Court Order. No exemption of railway property in this respect. At present no Income Tax in Sudan, but contributions made in areas where rates charged. The Railway contribute annually to Central Government.

ARGENTINE. — Government regulations for building. Restriction on increase of rents and eviction in 1944, but Railways have free hand to transfer staff for reasons of service.

INDIA. — Building regulations in large cities and towns. Also legislation to control rents and eviction. Railways exempt from latter legislation, as the houses provided are meant solely for Railway staff. Two railways indicate that no tax exemption is obtained, and the other railway states that tax contributions are agreed.

PART II.

Summary.

The replies to the Questionnaire confirm that the present housing shortage caused to a large extent by the recent war, is world-wide, although quite naturally the difficulties are greater in some countries than in others. Generally speaking, the problem is being dealt with by means of comprehensive Government and Municipal house construction schemes on a national basis, limited only by shortage of labour and restricted supplies of material. As far as possible, such limited resources are being drawn

into the national building efforts as distinct from sectional or private housing schemes.

This is particularly so in the case of the British Railways, where Railway Administrations themselves have no schemes for the provision of new houses, although a limited number of houses are being acquired for transferred staff in key positions, and some large houses are being converted into flats. The British Railways, are, however, owners of a large number of houses, many allocated to particular positions such as station masters, crossing keepers, etc., others are located in varying numbers up and down the systems, as well as extensive communities in big railway centres or depots, and the utmost use is made of this substantial housing accommodation during the present shortage. These houses were constructed in order that staff could live in the proximity of their work, and the overall rent does not adequately meet the cost of repair, depreciation and interest on capital involved. It can probably be said that the objects of the Railway Administrations have been achieved from time to time, and it would not be considered an advantage to the Administrations to provide houses for all grades of staff as account must be taken of the inherent desire of the individual to choose his own place of dwelling quite apart from the fact that it would be impracticable owing to the very large numbers involved. About 23 years ago, one Railway formulated a scheme for assisting in the provision of houses for renting to employees at several centres, where the housing position was difficult. The Administration acquired land and laid out roads, with sewers, etc., the sites then being leased to Associations of employees subject to appropriate ground rents. The Associations arranged contracts for the erection of houses, paying 10 % of the cost (subscribed by prospective tenant-members), and the balance of 90 % was advanced on mortgage by the Railway, being repayable over 50 years. These estates are managed by Committees of tenant-members and maintenance is done by permanent employees under Estate foremen. This is the only reported example of assisted house construction for renting to staff. The British Railways also operate staff housing loan schemes, either direct, or by arrangement with well-known Building Societies, repayments being made through the Railway paybills. Thus the British Railways provide houses for letting, assist in such provision, and arrange loans to staff for house purchase, but the schemes do not pretend to meet all staff housing requirements, as many thousands are reasonably and comfortably housed at moderate rents under local authorities or private owners with protection, under existing legislation, from eviction and increase in rents. It should be noted that modernisation and improvement of the older type of house is being undertaken as and when the existing shortage of labour and materials permits, and such facilities as electricity, gas, hot and cold water, bathrooms, water closets, etc., are being provided where these amenities have been non-existent.

The Railway Administration in Iraqi aim at providing accommodation for all staff necessary to operate the railway in order to secure efficient operation and to combat high rents prevailing. Building programmes are framed with due regard to funds available out of reserves, and rents are fixed at 1 % of cost. The accommodation so far provided has fulfilled the objects in view, and it would be considered an advantage if houses were provided for all the staff. No staff housing scheme is operated.

In New Zealand the policy of the Railway Administration is to purchase or build houses in localities where the shortage is acute and where this is of advantage from an operating point of view, also for transferred staff, the pri-

mary reasons being that without adequate accommodation in the right place staff requirements in certain localities would not be met. Rents are considerably cheaper than in the case of privately rented houses, and the last annual departmental dwelling statement shewed a considerable loss, but this is off-set by saving in lodging expenses. Accommodation so far provided has achieved objectives, but is still inadequate. If houses were available for all employees, staff changes would be facilitated, and mobility of staff increased. Improvements to older houses are undertaken in the way of additional services where previously non-existent. There is no railway housing loan scheme for staff; this would not add to mobility of staff as house ownership is considered to definitely discourage staff from accepting promotion and transfer.

The policy of the South African Railways is to provide houses for « free quarters » staff such as gangers and station foremen, and to erect houses for letting to staff who must live close to their work, or where private accommodation cannot be obtained so that employees can be comfortably housed and the exigencies of the service met where houses are scarce. Large numbers of houses are owned at important centres and big depots, and the accommodation so far provided has achieved the objects in view, but not to the full extent, and the annual programme will continue until adequate housing is attained, which ideal state it is estimated will be reached in ten years, although it would not be considered an advantage to provide houses for all staff. Money required for construction programme is voted each year as part of annual capital expenditure of undertaking, and rents are on a basis considerably lower than those of privately rented houses. Administration assists employees occupying rented houses by means of a rent rebate scheme whereby allowance is made of amount of rent in excess of one-fifth of substantive emoluments, subject to maximum refund of £4 per month. Also staff house ownership loan scheme on preferential lines with specially advantageous interest and repayment terms for lower paid staff. No opinion expressed as to effect of house ownership on mobility of staff, but special provisions are incorporated in scheme to assist in cases of transferred staff.

In Sudan, the Railway Administration's policy is to rent unfurnished accommodation to British Officials, Sudanese and others where essential to live close to their work, also quarters are provided in towns for general use of staff and at wayside or desert stations. Provision of new accommodation is undertaken for senior grades and certain other employees according to circumstances, and it is sometimes necessary to build houses for transferred staff. To a substantial extent construction so far has achieved objects in view, although some lag has occurred during war, but while there is day to day staff housing difficulty, it is not a major problem. Rents are not economic, being standardised for each type, and at the present time, private rents are higher. Provision of free quarters is made for certain lower paid staff. If houses were provided for all staff, the probability is that many would sub-let, as apart from those who own and wish to live in their own houses or live with relatives, others prefer to live away from the railway. Housing loans at favourable rates are granted to pensionable officials and employees in Provident Fund. This loan scheme was introduced recently, and its effect cannot be measured, but in a limited way staff ownership of houses may affect their fluidity.

The four Argentine Railways who replied to the Questionnaire provide houses when railway service reasons oblige Administrations to do so on account of local conditions, e.g., in the case of

transferred essential staff unable to find accommodation. Scarcity and the needs of service have caused the provision of houses, but the programme was completed many years ago, and there has been no new construction worthy of mention for several years. Originally, the objectives of the Administration were attained, but in certain cases staff have preferred to live elsewhere, abandoning houses erected for service reasons, and it would not be an advantage to provide houses for all staff as many personnel prefer to elect their own place of domicile. No Railway Staff Housing Loan Scheme exists, but there is a National Law, combined with Pension Fund Law for railwaymen, providing for loans; the Administration is not concerned, except to collect contributions through paybills. Trouble in connection with the transfer of staff has occurred from time to time where the transferee was an owner and occupier.

The two Railways in the United States of America who replied do not provide houses for any staff, nor do they assist in such provision by staff housing loan scheme or otherwise.

The policy of the Indian Railways who replied is to provide housing quarters mainly for staff who, by the nature of their duties, are required to live close to their work and where private enterprise is inadequate, the motive being to attain efficiency by means of a contented staff; also improves availability and mobility of staff. Existing schemes cover essential staff only, but in the post-war period more categories of staff will be included and quarters provided in the annual programmes. A Housing Committee appointed by the Board of the Indian Government Railways recently investigated the problem and such aspects as uniform layout and scales of accommodation, etc., have been dealt with. Generally speaking, rents are lower than for private houses, except at wayside stations where railway accommodation is superior to native. Lowest paid staff occupy accommodation rent free, and recovery of rent from remainder is subject to a maximum of 10 % of pay. This is usually uneconomic. On the whole, it can be said the Administration's objectives have been achieved, although it is realised that many more quarters are required, which it is hoped to remedy. It would not be considered an advantage to provide houses for all staff as many prefer to find their own living accommodation. No staff housing loan schemes are operated, although in the case of one Administration loans are given on a small scale by an Associated Co-operative Credit Society.

Before concluding, it might be of advantage to combine briefly the replies from all the Countries in particular relation to the subject heading of the Report. With two exceptions, the various Railways do not favour the provision of houses for staff of all ranks for the reasons that quite apart from the magnitude of such proposal, many staff are inclined to find their own accomodation, and in this connection it would be logical to assume that any scheme of complete housing by railways must necessarily be followed by compulsion of staff to live in such houses; moreover, difficulties would arise from the fact that altered domestic circumstances cause a constant fluctuation in the number of staff-householders at any particular place. This question is also affected by prevalent legislation controlling house rents and affording protection from eviction, since this protection to employee-tenants of privately rented houses might act as a deterrent against taking advantage of railway-owned houses; such legislation must also be taken into consideration in the case of railway-owned houses occupied by employees leaving the service (by retiral or otherwise) or by

widows of deceased members of staff, unless exemption is enjoyed by the Administration.

A considerable difference is found in the present policy and practice of Railway Administrations in regard to staff housing; on one hand there are two cases of total non-provision, and on the other hand one administration aims at fulfilling reasonable staff housing requirements within a given number of years; between these extremes, the other administrations pursue housing policies to a varying degree. In addition to direct provision of houses, one administration assists in such provision by means of a scheme for financing employee-tenant housing associations, and several administrations operate, either directly or indirectly, staff housing loan schemes for individual purchase of houses. One administration assists employees occupying privately rented houses by a rent rebate scheme when the rent exceeds a certain percentage of pay. Briefly, the advantages derived by administrations who provide and assist in the provision of houses for staff are stated to be that employees securely and comfortably housed give more efficient service and also that the existence of railway owned houses adds to the availability and mobility of staff, thus facilitating railway operation.

In conclusion, I should like to extend thanks to those Administrations who submitted information in reply to the Questionnaire.

[625 .13 (.73)]

Repairs Kingwood Bore by novel methods.

(The Railway Age.)

Employing interesting and effective methods, the « Baltimore & Ohio » has recently completed major repairs to the lining of its long, double-track Kingwood tunnel, near Grafton, W. Va., which involved rebuilding a section 528 ft. long and grouting repairs to most of the remainder, with all of the work being done under traffic at a time when it was imperative that neither of the tracks involved be taken out of service. Normally, major repairs to the tunnel would have been carried out by taking one of the tracks out of service.

The Kingwood tunnel is 4 202 ft. long and is located about 18 miles east of Grafton, on the main line from the eastern seaboard to Cincinnati, Ohio, and St. Louis, Mo. At this point there are three main tracks. The westbound main runs through a single-track tunnel, and the other two tracks, which handle traffic in both directions, pass through the double-track tunnel. In the latter tunnel, which was built in 1910, the grade is 0.4 per cent ascending for eastbound traffic and the alinement is tangent, except for a short section of curve at each end.

Roof shored in 1926.

The double-track tunnel was originally constructed with concrete side walls 2 ft. thick, extending to a point 9 ½ ft. above the base of rail, above which was a semi-circular arch roof consisting of

Looking west at east portals of new and old Kingwood tunnels.

five courses of brick. In 1926 the top part of the arch in a 528-ft. section, located approximately 1 000 ft. in from the west portal, failed, developing a large crack which extended longitudinally more or less along its center line. Although none of the arch fell, the center at some places sagged as much as 17½ inches.

Repairs were made immediately with heavy timber shoring supported on center posts between the tracks and by blocking from timber arches carried down the sides of the tunnel to subgrade. Eighty-four carloads of timber were used in this work. In addition, short sections of the tunnel lining at each end of the failed section (about 75 ft. in each case) were grouted at that time to prevent further extension of the failure. The timber shoring greatly restricted clearances in the tunnel and also constituted a fire hazard, although eventually normal moisture and the sulphur in the soot

deposits from locomotive stacks tended to make the wood fire resistant.

More recently, the tunnel, thus restricted, became a serious handicap, particularly because of heavy maintenance costs and the need during the war to use new and larger motive power. Accordingly, it was decided that the failed section of the lining should be rebuilt, and that the work, because of the heavy traffic prevailing, must be done without interfering with train movements, and with careful protection to prevent rock falls or cave-ins. To meet these specifications, an ingenious plan was devised by the contractor awarded the work, the « Bates & Rogers Construction Corporation », Chicago, and the project was begun early in 1944 and completed late in 1945.

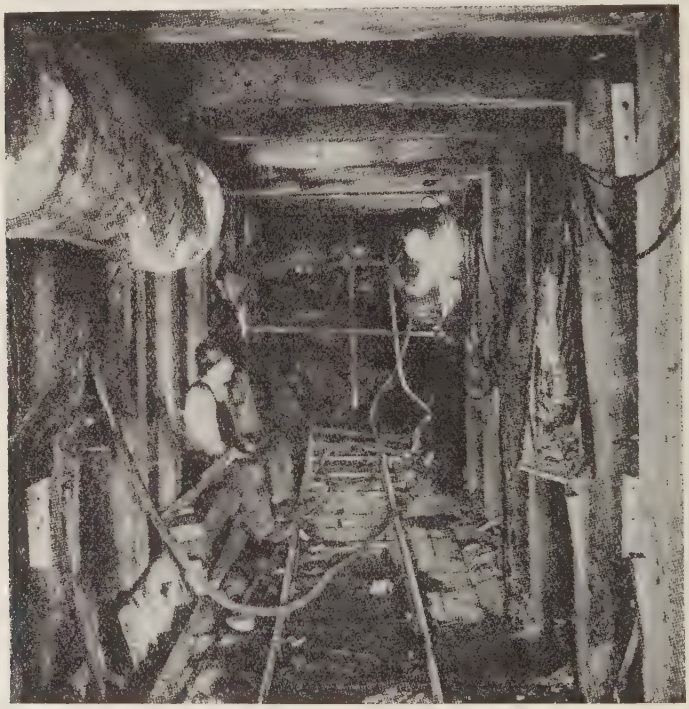
Head frame at the top of the vertical shaft. Note the ventilating fan and pipe.

Plan for repair.

To repair the 528-ft. section of tunnel lining under trafic it was planned to work from the top and to replace the crown of the old brick arch from quarter point to quarter point. Work was limited to this area because the old lining on each side, down to the springing lines, had not moved much and was in relatively good condition. In carrying out the plan, the contractor worked from a horizontal drift, 6 ft. by 7 ft., immediately above the top of the failed section of arch, which was reached at its mid-point by means of an 11-ft. by 14-ft. vertical shaft, 130 ft. deep, driven down from the surface. By this means, the material directly above and in the upper part of the old arch could be removed, new forms could be placed on the old timber shoring, and a new brick-faced concrete lining could be poured without interfering with traffic.

At first there appeared to be one serious drawback to the scheme, since frequent train movements kept the tunnel filled with smoke and it was known that, under normal conditions, it would be impossible to work in the smoke-laden air above the tunnel during and for some time after the passage of each

train. This difficulty was solved, however, by sealing off the working areas of the drift and by installing a ventilating system by means of which the working areas were kept relatively free of smoke and were soon cleared of all smoke after the passage of each train. The ventilating system, which involved the two parts, one for an electric cage-hoist, and the other for a man hoist, and for utilities, including the ventilating system, the electric and compressed air lines and a concrete pumping line. The drift excavated above the tunnel was also heavily timbered to guard against any possibility of rock falls, and a nar-



Drilling the crown drift east of the vertical shaft. Ventilating tube at upper left.

use of a fan at the top of the shaft, was the secret of the success with which the repair work was carried out, because without it, the overhead scheme, entirely in the clear of traffic, would have been impossible.

Shafts and ventilation.

Following the plan set up, the vertical shaft was sunk and was carefully timbered throughout. It was divided into

row-gage track for one-cubic yard side-dump muck cars was laid on a solid wood floor. Breakdown within the drift was done largely with jackhammers and by shooting, extreme care being exercised in the shooting to avoid injury to the tunnel below.

Once the drift was completed each way from the shaft, the lining renewal operations were commenced at both ends, working toward the shaft. A par-

tition, with a tight, swinging door, was constructed for each of the working areas, which were 10 to 15 ft. in length. Within these areas, which were constantly flooded with fresh air by the ventilating system, locomotive smoke was quickly driven out after the passage of trains. The men could escape the smoke during the passage of trains by waiting in the drift behind the partitions. A watchman with a whistle in the tunnel below warned the men of the approach of trains.

The ventilating system included a high-speed, 48-in. Robinson centrifugal fan with a capacity of 15 000 cu. ft. of air per minute, which was driven by a 50-hp. motor. Air from the fan was passed down through the shaft in a 26-in. steel pipe, which was connected at the bottom to two 16-in. fabric tubes, one extending to the working chamber at each heading, and delivering air at a pressure of approximately 2 lb. per sq. in. When the fan was operating, the smoke would rise only three to four feet in the working chamber during the passage of trains, coming up through the holes and cracks in the old timbering system, and after a few minutes the fresh air would force the smoke downward out of the chamber.

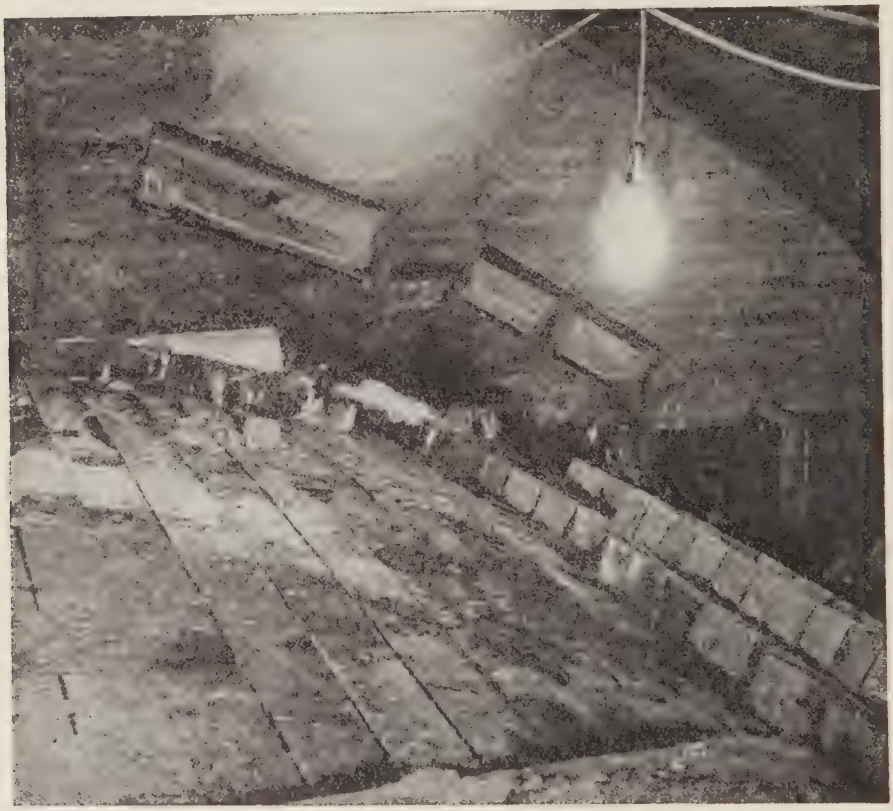
Removing the old brick crown near the east end of the repair section.

Repair operations.

Once the working chambers were set up, the first step was to remove all old packing, temporary timber lining (placed during construction) and loose rock from above the old brick arch. This material was loaded by hand into muck cars, which were pushed to the hoist, lifted to the surface, and unloaded. The space above the arch was then enlarged 3 to 7 ft. over the face to remove all

broken and loose rock, and this material was also mucked out. The enlarged rock face was supported by heavy shoring on the old brick arch, which, in turn, was supported from below by the timbering installed in 1926.

The supporting members of this shoring consisted of 12-in. by 12-in. pieces made up into 7-segment arches, spaced on $3^1/_2$-ft. centers. This new segmental timbering, which was lagged with two-inch lumber to form a tight roof, provided



Showing crown forms, new one-course brick wearing surface, and new crown concrete in the background.

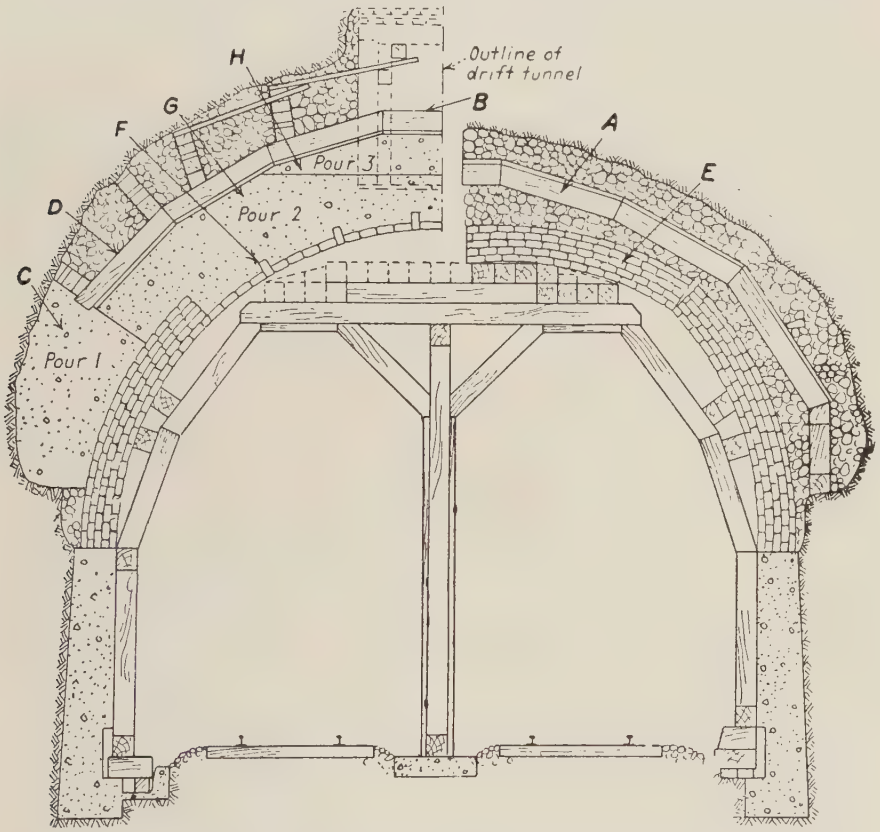
The next step in the work was to pour new concrete haunches, employing quick-setting cement, behind the lower third of the brick arch on each side. After this concrete had set up, new timber shoring was supported on the new haunches and was firmly wedged in place, relieving the earlier supports.

headroom approximately five feet above the top, or back side, of the old brick arch at the center line of the tunnel.

Renewing top of old arch.

With the new segmental shoring in place, it was then possible to remove the brick masonry of the old tunnel arch,

from quarter point to quarter point. This was done by breaking it up with pneumatic concrete busters, the material removed being used to pack the space above the lagging and segmental shoring. With the top part of the brick arch removed, the old solid timbering within the tunnel below was exposed and was used to support forms installed for the new concrete arch. On top of these forms, one layer of vitrified brick was placed for protecting the new concrete arch from locomotive blasts. After the brick facing was in place, the concrete of the arch was poured to a thickness of three feet at the crown. Subsequently, all of the space below the packing and new arch timbers was filled with concrete, the top concrete being placed in two pours to avoid placing too much



Half sections of the tunnel through the failed section of the arch, before and after repairs, showing the sequence of repair operations.

A) Remove old dry packing and temporary timber lining installed in original construction and left in place. Trim excavation; B) Set top five pieces of new timber bents temporarily supported on top of old brick arch; C) Place bottom lift of concrete in each side of arch; D) Seat bottom pieces of timber bents on concrete, wedge into place, remove temporary posts and lag the bottom of the bents with 2-in. plank; E) Remove damaged brick arch and top layer of timber support, using brick to dry-pack behind the bents; F) Set form for new arch and line with a one-course ring of vitrified brick; G) Pour second concrete lift; H) Pour third concrete lift and remove inside timber supports to complete the job.

load on the old tunnel shoring. This work was done progressively, and as much as 40 ft. of the old tunnel roof was open at a time in both headings.

All the concrete placed was mixed in a plant at the top of the vertical shaft and was pumped from that point, down through a drop pipe in the shaft, using a single-cylinder six-inch Rex pumpcrete machine. At the bottom of the shaft the drop pipe was connected to a feeder pipe to each heading. The arch forms and old lining supports were left in place until the work was completed, after which they were removed from below, using a work train with a scaffold erected in a gondola car.

Grouting work.

Immediately after repair of the 528-ft. section of tunnel lining, it was decided to grout the remainder of the lining to eliminate the possibility of other failures. Originally it was planned to use pressure grouting, and approximately 1 000 ft. of the lining, from the west portal to the rebuilt section, was grouted, using pumps. At the east end, however, the gravity method was used.

All of this work also was done without interfering with train movements and without killing a track. Holes were drilled 25 ft. apart in the center of the tunnel arch during periods between trains, using a work train and the gondola scaffold car which had been used to remove arch forms and lining supports in the repaired section of the tunnel. Short sections of pipe were caulked in place in the holes, ready for coupling to a two-inch flexible grout delivery hose. A two-inch grout pipe was laid on the tunnel floor between tracks and was extended to the grout mixing plant. The hose was attached to the delivery end of the grout pipe and was coupled successively to the pipes in the arch above. This vertical section of hose between tracks was securely fastened so that grouting operations could continue despite the passage of trains.

For pressure grouting, a mixer and re-mixer were used. The re-mixer was made on the job from a $^{3}/_{4}$-cu. yd. steel dump cart, and was equipped with revolving blades operated by an air motor. For delivery of the grout, Gardner-Denver and Cameron force pumps were employed, using 50-lb. pressure, but extensive repairs to the pumps were required because the grout was very abrasive. The repairs were made in the contractor's machine shop because replacement parts could not be obtained.

To eliminate pumping troubles, it was decided to grout the tunnel lining at the east end by gravity. Accordingly, the mixer and re-mixer were set up on the mountain at an elevation 70 ft. above the portal opening to obtain enough pressure to insure flow of the grout to and into the voids behind the tunnel lining. A total of 2 598 lin. ft. of tunnel lining at the east end was grouted successfully by this method. The pumps were kept in readiness, however, until it became apparent that satisfactory results were being obtained by the gravity method.

The grout used was a rich, liquid mix consisting of 1 part cement to 1 part sand. Altogether, 170 507 sacks of cement were used in the grouting work, which produced about 12 630 cu. yd. of grout, or approximately 3.6 cu. yd. per lineal foot of lining grouted.

The work described was done under the general direction of A. C. Clarke, chief ingineer of the « Baltimore & Ohio ». W. W. Gwathmey, Jr., at the time regional engineer at Baltimore, Md., and now engineer of construction, together with George F. Eberly, assistant maintenance engineer, were in charge, assisted by G. E. Norris, assistant engineer, Clarksburg, W. Va. James Strong, project manager, was in charge for the contractor.

[385 .4 (.42)]

L.M.S.R. commercial organisation.

New arrangements for maintenance of public contact.

(The Railway Gazette.)

One of the earliest activities of the Commercial Department of the L.M.S.R. in the formation of its post-war policy was the re-organisation of its arrangements for the maintenance of public contact. Two of the fundamental changes in the normal organisation and functions of transport undertakings, which followed the outbreak of war, were :

(*a*) The railways, and later other forms of transport, were directed by the Ministry of War Transport.

(*b*) Their primary function was the movement of Services personnel and merchandise on behalf of the Services and Supply Ministries.

In these circumstances, private travel was actively discouraged and the movement of merchandise for normal trade became of secondary consideration.

This stoppage of all ordinary commercial activity amongst transport undertakings brought in its train the partial disintegration of the pre-war corps of commercial representatives in direct touch with the public, and only a nucleus remained for the maintenance of contacts with the largest industrial undertakings.

Anticipating in 1944 an early end of hostilities, and realising that one of the immediate post-war needs would be the re-establishment of contact with, and personal service to, the trading and travelling community, the management decided to formulate plans which would enable it at once to put the organisation into operation at the appropriate time. A new technique in outdoor railway representation was envisaged so that the personal service to the public should be of the highest efficiency. The subject was, therefore, exhaustively examined throughout the line with a view to determining :

The best method of representation;

The number of representatives required;

The selection of personnel;

The method of training personnel;

The method of supervision and control;

and the facilities to be placed at the disposal of the representatives to assist them in the efficient conduct of their work.

The organisation ultimately authorised was framed on a standard pattern subject to such modifications as were necessary to meet the local requirements of the respective districts. Some degree of specialisation has been considered desirable, thus enabling a proportion of the representatives to be trained as specialists in the requirements of specific interests. These include representatives for :

The coal trade;

Livestock traffic;

Specified trades where these are in sufficient volume in a particular area to justify specialisation;

Passenger travel.

The remainder, and the majority, cover the following services :

Merchandise traffic (freight and passenger train);

All services (operating only in sparsely populated areas);

Merchandise traffic and disposal of town work, such as collection of accounts, and claims matters. — In towns not sufficiently large to justify the employment of both commercial representatives and townsmen.

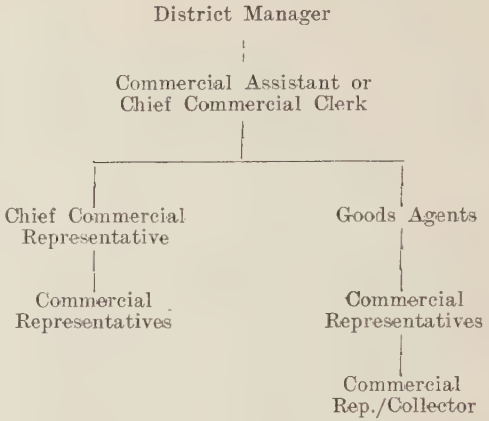
The number of representatives to be employed in England and Wales when the organisation is fully operative is 438, divided as follows :

Supervisors	16
Specialised trade representatives	65
Passenger travel	110
Merchandise services	181
All services	28
Combined representative/collector	38
Total	438

Of the representatives operating in districts where public transport facilities are infrequent, 92 will be supplied with light cars to increase their mobility.

The administration of the whole organisation is centred in the Chief Commercial Manager's Department at Headquarters, but with the exception of a few specialists employed there who cover the whole line for show, racehorse and theatrical traffic, the representatives are based in the 22 districts into which the line in England and Wales is divided, and are under the control of the respective district officers.

In the large districts they are under the direction of a Commercial Assistant and in others under a Chief Commercial Clerk. In certain large towns they are attached to the staff of the Goods Agent, the latter being responsible to the district officer for the commercial work in his area. The following chart illustrates the line of supervision in a typical district :



Careful consideration is given to the selection of representatives to ensure the appointment of only those who, by virtue of experience and personality, have the required qualifications. Recommendations are in the first place made by the district officers and each nominee is interviewed by a Headquarters Officer before appointment.

As aids to efficiency the representatives attend regular district conferences under the chairmanship of the district officer or his assistant. They are supplied with appropriate literature and trade journals. Each representative possesses a standard book record giving comprehensive information in regard to each trader on whom he is required to call and also of the facilities and physical features relating to every station in his territory.

Each newly appointed representative will undergo a course of commercial training at the Company's School of Transport at Derby. This is a residential school and the course is of three weeks' duration. Among the subjects included in the curriculum are :

The functions of transport;
The principles of salemanship;
Varying methods of sale in trade;
The writing of reports;
Geography;

Railway rates;
Study of terms and conditions of transit;
Railway facilities (transit and ancillary);
Study of warehousing;
Competitive road transport;
Associated road transport;
L.M.S.R. commercial organisation;
Talks by principals of trading organisations and visits to works to study transport problems;
Social habit in its effect on travel;
Cheap travel facilities;
Passenger fares;
Agency work;
Reading of timetables;
Catering for party travel;
Coaching regulations.

A separate course for passenger representatives is run concurrently with the merchandise course. The whole of the students receive tuition in subjects common to both; thereafter each is instructed in the subjects relating to his particular sphere of activity. The ultimate aim, when the staff position will permit, is that all representatives shall commence as trainees in the districts under the guidance of the permanent staff and afterwards attend the commercial course before their actual appointment. The trainee system is not yet in operation.

A similar organisation is operative in Scotland and ultimately 51 commercial representatives will be employed north of the border.

[691 & 725 .33 (.73)]

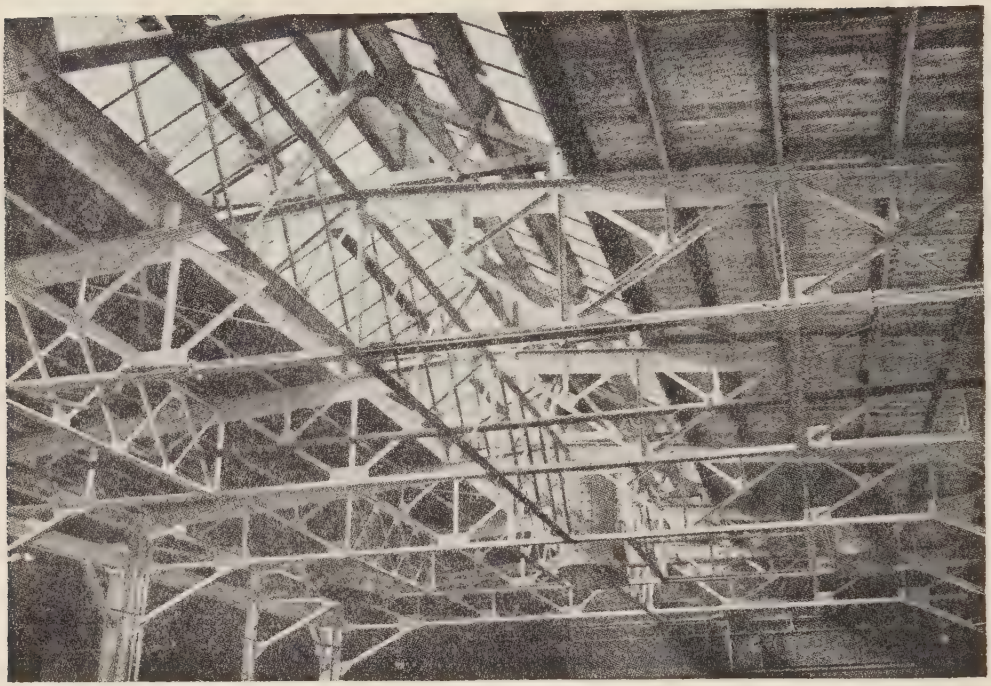
Engine house gets aluminum roof trusses.

(*Railway Age.*)

An unusual departure from conventional roof truss design was introduced recently when the « Alton & Southern » replaced several badly corroded steel roof trusses in its enginehouse at East St. Louis, Ill., with new trusses fabricated entirely from aluminium alloy structural shapes and rivets. Aluminum was selected for the renewals because of its known resistance to the corrosive conditions which had caused the early destruction of the steel trusses.

The enginehouse is a three-bay structure, with a high center bay and flanking lower bays to the north and south, the high bay and north bay having been constructed in 1912 as a car barn by an interurban line, and purchased by the A. & S. in 1920. The lower south bay, built a few years ago as an addition, with timber roof trusses, does not enter into the considerations of this article, nor does the north bay, which is used as a repair shop, even thought it has a steel roof structure. The problem lay in the high center bay, used for locomotive repairs, where the roof trusses had become seriously weakened by corrosion from locomotive stack gases.

The center bay, with three longitudinal tracks, is approximately 57 ft. wide, and extends for 112 ft. to a machine shop at its west end, from which it is separated by a brick wall. In the original design, a monitor was located continuously along the center line of the roof, supported on eight steel trusses of 57-ft. span, which also carried the sloping roof decks on each side. Six of these trusses were located in the locomotive repair section of the bay. Subsequently, when the building was diverted from



Interior of the enginehouse showing the aluminum alloy trusses in place.

housing street cars to housing locomotives, two wooden smokejacks were installed above each of the three locomotive tracks, supported by steel rods hung from adjacent trusses.

Heavy loss in cross section.

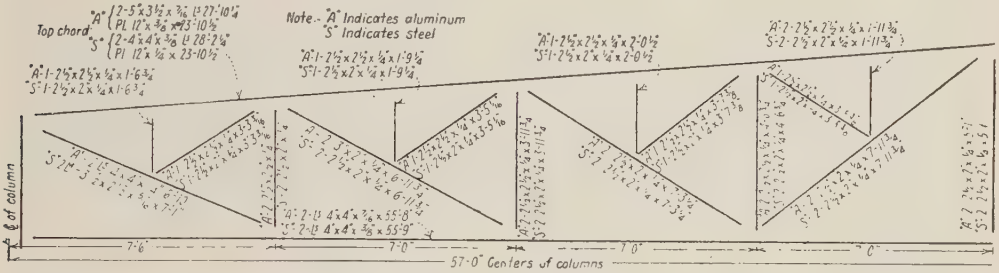
Although the building has been used by the railroad as an enginehouse since 1920, it has been used intensively only since 1930. In spite of this, routine inspections in recent years showed progressive weakening of the trusses due to the corrosive action of the sulphurous fumes from locomotives, a condition which was permitted to exist only because of the war-time restrictions on materials that would withstand such conditions. This condition persisted until, of the six trusses in the locomotive section, four were found to have become so badly corroded as to require replacement. A fifth truss had four badly damaged main web members, which could be replaced, while the sixth was not affected appreciably. An indication of the condition of the more seriously affected trusses is seen in the fact that nearly all of their members were reduced in cross section to some extent; some, especially in the top chords, which were subject to the greatest concentration of gases, having remaining as little as 40 to 20 percent of their original section.

In one truss, the most badly corroded, there was a reduction in area of as much as 80 per cent in the top chord, and of 17 per cent in the lower chord. At the same time, reductions of 12 to 80 per cent were found in 93 per cent of its main web members, and reductions of

42 to 68 per cent in 70 per cent of its secondary members.

Unexpectedly available.

Because of fear of possible collapse of the roof under a heavy snow, immediate repairs were considered necessary. However, structural aluminum, which was preferred for making the renewals, was not then available, and lumber was not adaptable to the conditions existing. Accordingly, it was decided, in spite of the experience with the original steel throughout for the aluminum trusses. In fact, the only changes made were those necessary to obtain the proper cross-sectional areas of a few members to accomodate the design tresses. In general, these changes proved to be relatively minor, as may be seen in the sketch, which shows the sizes of the structural members in both the steel and aluminum designs. In determining the required aluminum sections, a tensile strength of 16 000 p. s.i. was used, following design data set forth in the



Sketch of a typical truss, indicating the size and composition (A) of the aluminum alloy members. Similar information (S) is shown for the steel members in the original design.

structure, to use steel again in renewing the four trusses requiring replacement. Before this plan could be placed into effect, however, aluminum became available, and it was then decided to use aluminum alloy structural shapes in the four trusses, and to employ steel only in replacing the damaged web members of the fifth truss. In addition to renewing the roof trusses, certain other changes were planned for the roof, including the replacement of the old monitor with a combination skylight-ventilator construction, and the replacement of the old wooden smokejacks with fire-resistant smokejacks.

With the unexpected opportunity to use structural aluminum in the new trusses, rather than steel, and in the interest of early completion of the work, the original steel design was used almost

Alcoa Structural Handbook, but there was no attempt to use the most economical sections in every case since it was more expedient under the circumstances to adhere as closely as possible to the steel design and to use aluminum shapes in sizes most readily available.

The structural shapes in the new trusses are of Alcoa 61S-T aluminum alloy, with all connection rivets of Alcoa 53S-T-61 aluminum alloy. All material was furnished by the « Aluminum Company of America », Pittsburgh, Pa., and was fabricated in the shop of « Stupp Brothers Bridge & Iron Co. », St. Louis, Mo. Prior to assembly, all of the structural shapes were cleaned with a solution of phosphoric acid-alcohol cleaner and were then painted with two coats of zinc chromate paint. All shop rivets were cold driven, but all field rivets

were heated to a controlled temperature to insure uniformity of heating. The weight of each of the new trusses is only 1 805 lb., compared with 4 255 lb. in the steel design.

The « Fruin-Colnon Contracting Company », St. Louis, erected the trusses, using a single locomotive crane to set each truss as a complete unit. After erection, a new roof deck was applied, consisting of 2-in. by 6-in. yellow pine, covered with a 20-year, bonded, built-up roofing, and the aluminum trusses and two existing steel trusses were given two finish coats of aluminum paint.

The new skylight replacing the old monitor is 14 ft. wide, with an 18-in. ventilator opening in the center throughout its 112-ft. length. The skylight is of corrugated wire-glass sheets, bolted to wood purlins supported by light frame trusses, which, in turn, are carried by the main roof trusses. The corrugated wire glass and fastenings were furnished by the « H. H. Robertson Company », Pittsburgh, Pa.

The ventilator has sides of $^1/_2$-in. Johns-Manville Transite sheets, and a cap, or cover, consisting of one-third segments of 36-in. Transite pipe. The six new smokejacks installed are also of Transite, these being supported by aluminum alloy rods hung from wooden frames extending between the top chords of adjacent trusses.

The planning and execution of this work were carried out under the supervision of W. J. Neubling, chief engineer of the A. & S., East St. Louis.

[**385.** (09 (.492) & **623** (.492)]

The Netherlands Railways, 15 months after liberation.

5th MAY 1945 — RECONSTRUCTION — AUGUST 1946.

(Notes issued by the Netherlands Railways Press Service).

For more than seven months, from the 17th September 1944 to the 5th May 1945, the operation of the greater part of the Netherlands Railway system was at a standstill. The stations and their equipment, the tracks, the signal boxes and bridges were all in a state of ruin. When menaced by defeat the enemy systematically destroyed the railway. With precalculated thoroughness, the Germans put all their destructive forces at work, so that at the moment of liberation, the railway system of the Low Countries was in ruins; it even looked as though it would be a hopeless task to attempt its reconstruction.

The work of reconstruction has in fact not been at all easy, especially on account of the shortage of indespensible material. However, the Dutch railway men at once took in hand the work of restoration, and very shortly the first trains were running again. At the beginning, however, trains were only available for provisions and the repatriated, but ordinary passenger traffic was soon restored.

Since then 15 months have passed,

Examples of the systematic destruction of bridges in Holland.
76 % of the important bridges were destroyed.

months of heavy toil for all the railway staff, from the highest to the lowest grades. It has been in fact a period during which all sorts of difficulties have had to be overcome; in addition new problems had to be faced requiring exceptional solutions. These difficulties

At the liberation, the rails of the Moerdijk Bridge ended in the waters of the Hollandsch Diep.

have all been surmounted somehow or other and solutions found, even if they had to be improvisations which had first of all to be tested seeing that safety is of prime importance in the operation of a railway. Bit by bit, mile by mile, bridge by bridge, the Netherlands Railways have been rebuilt.

The work of restauration is still in hand, and far from being completed. However, this seems to be a good occasion on which to review the work done during the last fifteen months. The figures given below speak for themselves.

In September 1944, the Netherlands Railways operated 3 159 km. (1 963 miles) of line. By the 5th May 1945 this figure had been reduced to 1 954 km. (1 214 miles), i.e. 62 % of the lines were destroyed or damaged. At the present time, 15 months later, 2 881 km. (1 790 miles) have been opened to traffic. The electrified system covered 566 km. (352 miles) in September 1939, and 520 km. (323 miles) or 92 % of this was destroyed or rendered useless. At the present time 213 km. (132 miles) are already working, and during the course of the summer a certain number of other lines will be restored.

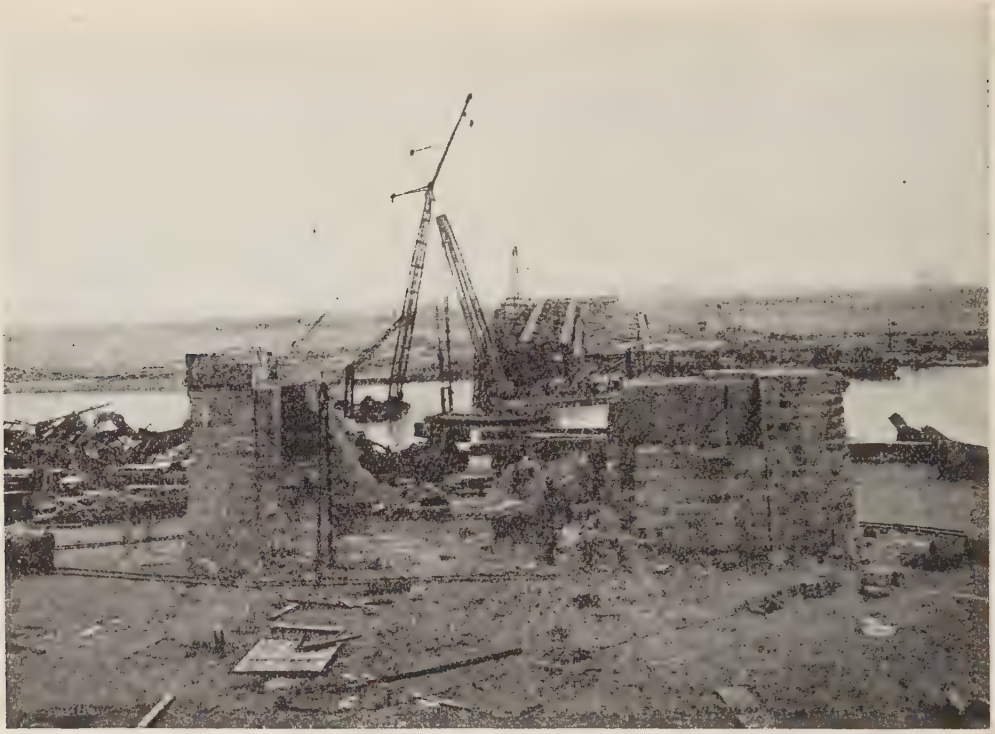
Out of the 21 bridges over wide rivers, 16 (76 %) were destroyed, or at least rendered useless. Thanks to our great efforts and the assistance of our Allies, 12 of these bridges (57 %) are once more in service.

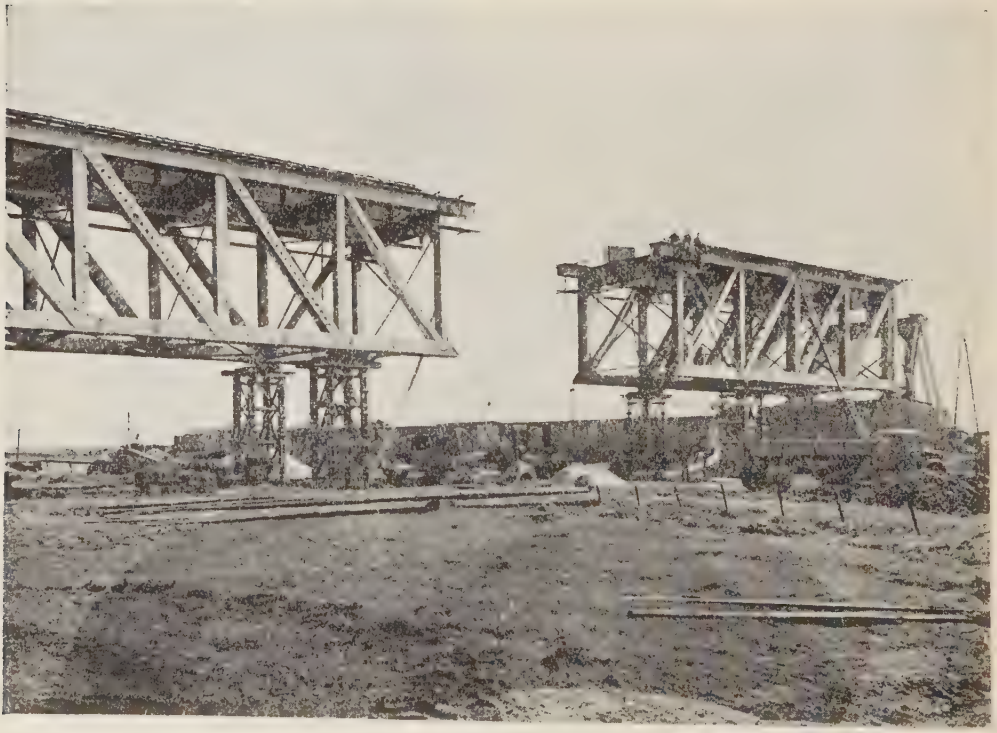
Another figure which gives an excellent idea of the progress made during the last fifteen months is the daily train mileage. In September 1944 the figures were 61 700 passenger train km. (38 339 passenger train miles) and 39 000 goods train km. (24 233 goods train miles); on the 5th May 1945, thanks to the restoration of the lines in the south of the country, these figures had risen to 1 892 (1 175) and 2 100 (1 305) respectively. At the present time, i.e. 15 months later, the daily output is 55 000 passenger train km. (34 175 passenger train miles) and 33 000 goods train km. (19 883 goods train miles), i.e. 89 % and 85 % respectively.

View of the Moerdijk Bridge, severely damaged by the Germans.

Another view of the Moerdijk Bridge.
The Moerdijk Bridge with its 14 arches was the longest bridge in Europe before the war.

Views showing the reconstruction of bridges shortly after the liberation.





The greatest difficulty encountered in the work of reconstruction has been the world shortage of raw materials; this also explains why the other figures given appear less favourable. As regards passenger rolling stock, the Netherlands Railways had a total of 163 000 seats available in September 1944; during the railway strike organised by the Higher Command of the Allied Forces in order to sabotage the provisioning of the German army, this figure was reduced of 156 000 seats (96 %). This was due to the fact that the Germans pillaged and destroyed a great number of vehicles. In addition, the shops in which stock could be repaired were destroyed, and reduced to such a condition that even at the present time hardly any repairs can be carried out. As a result, the Netherlands Railways have only 69 783 seats available at the present time (43 %). Obviously under these conditions it is hard for passengers to get a seat in the trains.

Six months after the liberation, the first train ran over the temporarily rebuilt Oosterbeek Bridge.

Finally, as regards the rolling stock, naturally it was here that the enemy had the greatest opportunities for pillage. Thus 137 streamlined electric sets still in the possession of the Railway in Sep-

tember 1944 were stolen or destroyed, as well as 57 diesel-electric sets and 25 diesel railcars, of which the Netherlands Railways were justifiably proud. The great part of this material disappeared over the frontier. The stock which has been recovered — an infinitesimal proportion — has been returned to Holland in a deplorable state. However, they have managed to repair some of this stock in their damaged shops, so that at the present time the following are available to the public : 40 streamlined electric sets (29 %), 16 diesel-electric sets (28 %), and only 6 diesel railcars (24 %).

Of the non-streamlined railcars and trailers for electric traction, 98 % (294 units) were destroyed or pillaged; 157 (52 %) units of this category are now available.

As for steam locomotives, the Germans stole or destroyed 722, which is 84 % of the 866 locomotives owned by the Netherlands Railways at the outbreak of war. More than 400 of these locomotives have been recovered, but in such a state that many of them could not be put back into service; although a certain proportion will never be usable again, they are nevertheless extremely valuable for spares to enable other locomotives to be put back into service. A certain number of these engines have been repaired by the Tilbourg shops, as well as by private firms. At the present time the Netherlands Railways have 429 locomotives which can be used, including 41 new Swedish locomotives and 29 Swiss locomotives. An order for 22 locomotives for express trains is in hand.

The question of locomotives is the great difficulty in drawing up the timetables. However it should not be forgotten that the Railways have at their disposal 300 English war locomotives which they have been lent, but these are also getting the worse for wear. Even with the help of private firms, the rhythm of the work of repairing locomotives cannot catch up with the wear. The result is that the stock of locomotives is decreasing, while it takes longer and longer to carry out repairs.

Owing to the very reduced mileage of electrified lines which it has so far been possible to restore, the railways need a greater number of steam locomotives than they did before the war. This explains why the traffic over most of the system is less intensive than the public — as well as the railway — would like it to be.

A second difficulty is the shortage of rolling stock for steam traction. At the outbreak of the railway strike, 1 498 coaches were available, but now there is a shortage of 1 406 or 94 % due to pillage and destruction. At the present time the Railways have only 425 carriages available (28 %); this is insufficient, even when the use of 301 carriages from foreign sources is taken into account. Consequently the Company is often obliged to use goods wagons or vans for the transport of passengers.

However a great improvement is expected in the near future. The Company has a great deal of work in hand, and every thing possible is being done to continue the restoration of the railway traffic as actively as during the past fifteen months, so that the slogan of the past can once again be verified : *Safe, fast and economical.*

[656 .225 (.42) & 656 .261 (.42)]

L. M. S. R. new insulated containers,

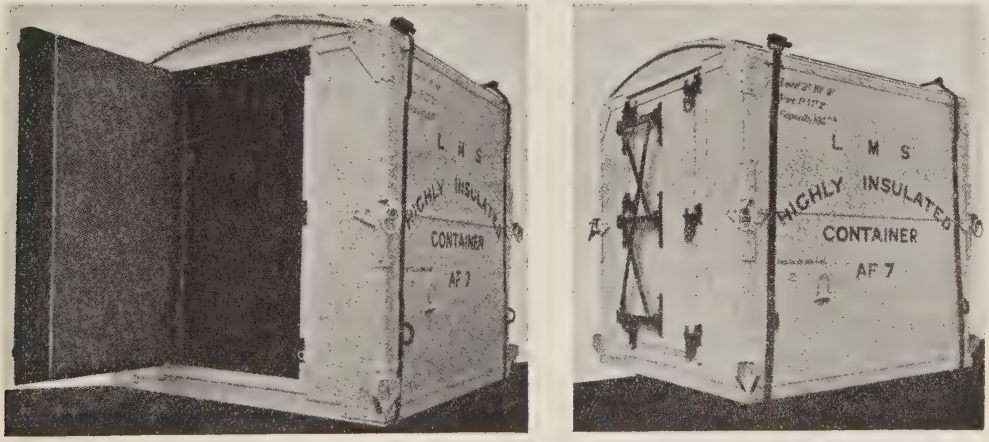
Experimental type for low storage temperatures.

(The Railway Gazette.)

Two new highly insulated containers of an experimental type (coded « AF ») built recently in the Earlestown Works of the L.M.S.R., have been put into trial service for the carriage of commodities requiring specially low temperatures during transport, with minimum variation of temperature. It is expected that they will be of special value in the transport of such materials as frozen pancreas glands (for the manufacture of insulin), « quick frozen » foods, and ice-cream.

They were designed primarily for ice-cream traffic, which, with the « quick frozen » foods, requires a lower storage temperature than has been needed for ordinary frozen traffic, normally not below 15°F. The new container have been designed to maintain temperatures as low as 0° F. or less with, at most, only a few degrees rise in temperature of the load during transit.

Dimensions and also thickness of insulation are based on experience with highly-insulated containers originally known as « E » type; compared with them the capacity has been increased as far as possible, and the insulation thickness increased from 6 in. to 9 in. The insulating material is of « expanded rubber » of good thermal properties and lightness.



Two views of the new L.M.S.R. highly insulated container.

Tests have been made and will be continued. So far, the expected performance has been realised and the rate of heat leak is approximately 10 B.t.u. an hour per degree F. difference in temperature between the interior and the exterior. This is equivalent to a rise in temperature of the order of 60° F. a day for a full load without extra refri-

gerant and with an outside temperature of 60° F. One test consisted of recording the variation of temperature of the air inside and empty container during 24 hours when the ambient temperature varied over 33° F. In spite of the added adverse feature of bright sunshine during the day, the variation recorded did not exceed 3° F.

From these results it is expected that in all the normal transits less refrigerant material will be needed with the loads, and that when this may be necessary the quantity will be small compared with that required in any other vehicles at present in use.

Construction and dimensions.

The construction is timber, with exterior and interior resin-bonded multiply panels. The inside panels are faced with galvanised steel sheets; all joints are soldered to present a continuous flush surface over the whole of the interior.

In order to prevent damage to the floor surface there are timber gratings in birch or sycamore instead of the more common hardwoods to obviate any tendency for the natural odour from such woods to contaminate the loads.

The timber framing is designed on the principle of separate frames for the inside and outside panels with no ironwork penetrating the total wall thickness. The main insulation is accommodated between the interior and exterior panelling in the spaces between framing members; in addition to this, the framing members for the inside panelling are insulated from those for the outside panelling where they cross.

The door, designed to reduce heat leak to a minimum, is of full thickness and supported at its vertical centre line by the three main hinges. It is sealed when closed by six clamps which give approximately uniform pressure all round on a rubber gasket of generous dimensions. Although refrigerant is not expected to be necessary as a regular practice, six hooks are provided in the container ceiling to support net bags for dry ice in case this is required for long journeys or in particularly difficult conditions of temperature.

Each container, which will carry a load of 2 tons 10 cwt., has the following inside dimensions :

Length	5 ft. $10^3/_4$ in.
Width	5 ft. $4^3/_4$ in.
Height at centre	6 ft. $2^9/_{16}$ in.
Height at sides	5 ft. $9^9/_{16}$ in.
Capacity	193 cu. ft.

The tare weight is 1 ton 17 cwt. 2 qr.

[621 .33 (.42) & 621 .431 .72 (.42)]

Southern Railway £ 15 000 000 electrification and diesel traction plans,

Elimination of steam traction in south-eastern England.

(*The Railway Gazette*).

On Thursday 31st. October last, Sir Eustace Missenden, General Manager, Southern Railway stated that the board of the Southern Railway Company had approved large-scale plans for the extension of electrification and for the adoption of diesel traction for subsidiary services.

The programme of extensions, which, at present price levels, is estimated to

cost £ 15 000 000, will affect train services throughout south-east England, and will result in the elimination of steam locomotives from the lines of the former London Brighton & South Coast and South Eastern & Chatham Railways.

Time factor.

The time which will elapse before conversion is completed, is dependent directly on availability of material and

version to electric traction of 284 route-miles (610 miles of single-line track, including sidings) on the main lines to the Kent coast and on secondary routes to Brighton. These routes are :

Gillingham to Margate and Ramsgate, with the secondary line from Faversham *via* Canterbury to Dover.

Sevenoaks *via* Tonbridge, and Ashford to Folkestone, Dover, Deal, Sandwich, and Ramsgate, with the secondary lines

Southern Railway £15 000 000 electrification and diesel traction scheme

Map showing the present extent of the Southern Railway electrified system and the lines to be electrified under the scheme announced. The lines shown as « non-electrified » will in general be operated by diesel-electric locomotives. The principal stations affected by the new electrification scheme are shown in heavy lettering.

labour, but it is hoped that the work will be completed by 1955. With full priority for labour and materials it is estimated that the project could be accomplished in five years.

The proposals involve the further con-

from Maidstone to Ashford, Maidstone to Paddock Wood, and Ashford *via* Canterbury to Ramsgate.

Tonbridge *via* Tunbridge Wells to Bexhill and Hastings.

The secondary line to Haywards

Heath and Brighton from South Croydon *via* Oxted, East Grinstead, and Horsted Keynes.

The secondary line from Horsham *via* Steyning to Shoreham.

All passenger and freight trains in the counties of Kent, Surrey, and Sussex eventually will be worked by electric traction, either by multiple-unit electric stock, or trains hauled by electric locomotives. Diesel-electric traction will be used for feeder services and local goods trains. Steam train services to and from London termini will be withdrawn.

At present, the Southern Railway owns over 1 800 steam locomotives. When conversion is complete, the number will be reduced to less than 800. The schemes of electrification already in operation on the Southern Railway are estimated to effect a saving of some 400 000 tons of coal a year.

The extensions which have just been announced, together with the adoption of diesel traction, are expected to result in a further saving of 300 000 tons of coal each year.

The Southern Railway route mileage is 2 156, of which 714 miles, or nearly one-third of the total system, are already electrified. The mileage of electrified single-line track, including sidings, is 1 777. Of the total train mileage, 55 per cent. at present is worked electrically, and the remaining 45 per cent. by steam.

The new programme will require for its operation 200 diesel-electric locomotives, and 150 electric locomotives. When it is complete, the division of trains operated will be in the ratio approximately of 70 multiple-unit trains to 30 trains hauled by electric locomotive or diesel-electric locomotive.

Approximately 60 sub-stations will be involved in the extension of electrification, and the return on the capital involved in the project is estimated at six per cent.

Locomotive design.

The electric locomotives to be used will be generally similar to those described and illustrated in *The Railway Gazette*, January 23, 1942, issue. Tests have been carried out with these locomotives, particularly with goods trains, for a considerable period, and the results achieved as a result of these tests have been highly satisfactory.

The diesel locomotives to be used for shunting and other subsidiary services will be of from 400-600 h.p.

Sir Eustace Missenden also stated that conversations would take place with manufacturers as to the design of a main-line diesel-electric locomotive for use on the Western Section of the Southern Railway.

It is expected that one of the major results of the measures to be taken will be the achievement of a reduction and a greater uniformity in headway, and an overall speeding up of services in the area affected.

Considerable research was undertaken by the Southern Railway before the present plan was put forward, and a special mission of officers made visits to the United States of America and to the Continent to study diesel traction.

This delegation, on whose report the present scheme largely is based, consisted of Mr. J. L. Harrington, General Assistant to the General Manager, Mr. S. A. Fitch, Assistant Superintendent of Operation, Mr. M. S. Hatchell, Assistant to the Chief Mechanical Engineer, and Mr. S. B. Warder, New Works Assistant to the Chief Electrical Engineer.

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PUBLISHED UNDER THE SUPERVISION OF

P. GHILAIN,

General Secretary of the Permanent Commission of the International Railway Congress Association.

(DECEMBER 1946)

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In French.

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1946 **691**
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Nouveaux **procédés d'imprégnation des poteaux en bois.** (1 200 mots & fig.)

1946 **621 .35**
Electricité, septembre, p. 187.
GENIN (G.). — L'appréciation de l'état de charge des **batteries d'accumulateurs.** (5 000 mots & fig.)

1946 **621 .31**
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Génie Civil. (Paris.)

1946 **62. (01 & 669**
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1946 **691**
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1946 **385. (09 (.55)**
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Les **Chemins de fer de l'Iran.** (500 mots & carte.)

1946 **62. (01 & 721 .1**
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de BEER (E.). — Contribution à l'étude de l'**équilibre limite de rupture du sol** sous des massifs de fondation transmettant des charges centrées. (6 000 mots & fig.)

1946 **691**
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VALLETTE (R.). — La granulométrie rationnelle du **béton :** le néobéton. (1 800 mots.)

1946 **623 (.492) & 624 (.492)**
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BIJLS (A.). — La **réparation des grands ponts-route métalliques** aux Pays-Bas. (1 500 mots & fig.)

1946 **656 (.44)**
Génie Civil, nº 3182, 1er juin, p. 147.
L'avenir des **transports** et de l'automobile. La politique française de la route. (800 mots.)

1946 **625 .233 & 656 .215**
Génie Civil, nº 3183, 15 juin, p. 157.
ADAM (M.). — L'**éclairage par lampes-tubes fluorescentes.** (1 500 mots & fig.)

L'industrie des voies ferrées et des transports automobiles. (Paris.)

1946 **625 .2 : 625 .62 (.494)**
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VENTE. — Les réseaux de transport en commun de Zurich, Berne et Lausanne et leur **matériel roulant.** (7 000 mots, tableaux & fig.)

1946 **625 .214**

L'Ind. des voies ferrées et des transp. autom., septembre, p. 9; octobre, p. 7.

JOUR (R.). — La **lubrification des fusées d'essieux** dans les boîtes à tampons graisseurs. Caractéristiques et essais des huiles utilisées. (6 000 mots & fig.)

1946 **625 .61 (.5 + .6)**

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PIALOUX (I.). — **Chemins de fer coloniaux français.** Les difficultés d'exploitation nées de la guerre. Les solutions adoptées pour y faire face. (3 000 mots & fig.)

Revue générale des chemins de fer. (Paris.)

1945 **625 .212**

Revue générale des chemins de fer, mars-avril, p. 25.

GALIBOURG (J.). — Les traces laissées dans le métal des essieux par le **chauffage des boîtes.** (4 500 mots & fig.)

1945 **625 .212 & 625 .214**

Revue générale des chemins de fer, mars-avril, p. 36.

ARNAUD. — Normalisation des **organes de roulement** de voitures et wagons. (2 400 mots, 2 tableaux & fig.)

1945 **625 .251**

Revue générale des chemins de fer, mars-avril, p. 40.

PEDELUCQ. — Application pratique de la formule de **freinage des trains de voyageurs** au moyen d'un nomogramme à points alignés. (1 900 mots & fig.)

1945 **621 .132 .5 (.42 + .73)**

Revue générale des chemins de fer, mars-avril, p. 44.

Les **locomotives de guerre 140 et 150** anglaises et américaines. (1 200 mots & tableau.)

1945 **656 .257 (.44)**

Revue générale des chemins de fer, mai-juin, p. 49.

WALTER. — Evolution des **postes électriques d'aiguillages à leviers d'itinéraires.** (5 000 mots & fig.)

1945 **621 .335 (.44)**

Revue générale des chemins de fer, mai-juin, p. 58.

VILLENEUVE. — Progrès et perspectives d'avenir des **locomotives électriques** à service mixte (type BB) de la S. N. C. F. (3 000 mots, 5 tableaux & fig.)

1945 **385. (09 .1 (.69)**

Revue générale des chemins de fer, mai-juin, p. 62.

GOUDARD (J.). — Le **Chemin de fer** de l'île de la Réunion. (1 500 mots & carte.)

1945 **621 .132 .8 (.43)**

Revue générale des chemins de fer, mai-juin, p. 64.

COLOMBAUD. — Note sur la **locomotive allemande à condensation** 150-E-21. (1 200 mots & fig.)

1945 **385 .586 (.44) & 654 (.44)**

Revue générale des chemins de fer, mai-juin, p. 66.

GAILLARD. — L'Ecole S. N. C. F. des **télécommunications.** (500 mots & fig.)

1945 **621 .392**

Revue générale des chemins de fer, mai-juin, p. 67

LAFRANCHIS & LEVASSEUR. — Orientati donner à l'**outillage de soudure** des ateliers de che de fer. (1 100 mots.)

1945 **656 .22**

Revue générale des chemins de fer, juillet-août, p.

LORRIOT. — Le **rôle de la S. N. C. F.** dans le triement des prisonniers et déportés. (1 500 mots &

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LEHUEDE (R.). — Réflexions sur l'évolutio France des **postes électriques à leviers d'itinér** (3 000 mots.)

1945 **621 .1**

Revue générale des chemins de fer, juillet-août, p. 7

CHAN. — **Explosions de chaudières de locomo** Recherches des causes. (1 000 mots & fig.)

1945 **621 .33**

Revue générale des chemins de fer, juillet-août, p.

FIOC (A.). — Le développement de l'**électrific** des Chemins de fer français. Monophasé 15 000 Continu 3 000 V. ? ou continu 1 500 V. ? (5 000 & fig.)

1945 **623 (.42) & 624**

Revue générale des chemins de fer, juillet-août, p.

Le **pont militaire « Bailey ».** (500 mots & fig.)

1945 **625 .2**

Revue générale des chemins de fer, septembre-oct p. 97.

BLONDEL. — Le **lacet des véhicules** et la stabili la voie. (3 000 mots & fig.)

1945 **65**

Revue générale des chemins de fer, septembre-oc p. 104.

KIPFER. — Quelques réflexions sur la **cinéma de l'exploitation** ferroviaire. (1 000 mots.)

1945 **625**

Revue générale des chemins de fer, septembre-oc p. 105.

KAMMERER. — La **fatigue des essieux** et la dé nation de leur forme et de leurs dimensions. (3 000 & fig.)

1945 **621 .132 .5**

Revue générale des chemins de fer, septembre-oc p. 115.

Locomotives américaines de guerre. (1 300 mots &

In German.

Der Bahn-Ingenieur. (Berlin.)

1941 **625 .151 & 66**

Der Bahn-Ingenieur, Nr. 42, 19. Oktober, S. 501.

HENTSCHEL. — Stoffersparnis durch **autogene schweissung von Herzstücken und Weichenzungen.** Wörter & Abb.)

1941 **621 .138**

Der Bahn-Ingenieur, Nr. 44/45, 2./9. November, S

SCHMIDT (O.). — **Unterhaltung der Dampflo tiven** der französischen Eisenbahnen, insbesonde ehemaligen französischen Ostbahn. (1 000 Wörter &

)41 625 .113
Bahn-Ingenieur, Nr. 48/49, 30. November/7. Dezember, S. 565.
ÖFER. — Die Wirkung des Einschachtelns im **Biegefahren.** (3 500 Wörter, 7 Tafeln & Abb.)

)41 625 .26 (.43)
Bahn-Ingenieur, Nr. 48/49, 30. November/7. Dezember, S. 571.
OFFMANN (O.). — Die Zeit- und Stückrechnung bei **Fahrzeugerhaltung.** (3 000 Wörter.)

)41 625 .216
Bahn-Ingenieur, Nr. 48/49, 30. November/7. Dezember, S. 575.
LRICH. — Fahrbarer Ausbesserungsstand für **Hülluffer** mit Schraubenfedern. (600 Wörter & Abb.)

)41 625 .113
Bahn-Ingenieur, Nr. 50/52, 14./28. Dezember, S. 585.
CHRAMM (G.). — Umgestaltung des **Winkelbildverens** (Biegeverfahrens) ? (2 700 Wörter & Abb.)

)41 625 .113
Bahn-Ingenieur, Nr. 50/52, 14./28. Dezember, S. 588.
ÜCHENHOFF. — **Kurvenabsteckungen.** (1 800 Wör- & Abb.)

)41 621 .134 .2
Bahn-Ingenieur, Nr. 50/52, 14./28. Dezember, S. 597.
OCH (K.). — Störungsmöglichkeiten an **Druckaushschiebern.** (2 000 Wörter & Abb.)

)42 624
Bahn-Ingenieur, Nr. 1/2, 4./11. Januar, S. 2.
AILER (I.). — **Verstärkung von Eisenbahnbrücken** h Hängewerke. (900 Wörter & Abb.)

)42 656 .254 (.43)
Bahn-Ingenieur, Nr. 1/2, 4./11. Januar, S. 11.
ber die Sicherung von **Wegübergängen.** (1 200 Wör-

)42 625 .143 .5
Bahn-Ingenieur, Nr. 3/4, 18./25. Januar, S. 21.
)RENZ. — Über **Schienenwanderung** und ihre Bepfung. (1 500 Wörter & Abb.)

)42 625 .151 & 625 .174
Bahn-Ingenieur, Nr. 3/4, 18./25. Januar, S. 32.
CHUPP (E.). — Beseitigung und Verhinderung des **chneiens von Weichen.** (1 000 Wörter & Abb.)

)42 625 .24 (.43)
Bahn-Ingenieur, Nr. 5/6, 1./8. Februar, S. 41.
AYSER (W.). — Der **technische Betriebswagendienst** Reichsbahn unter besonderer Berücksichtigung der stgüter-, Bahndienst- und Bahnhofswagen. (5 000 ter & Abb.)

)42/1943 654 (.43) & 656 .254 (.43)
Bahn-Ingenieur, Nr. 7/8, 15./22. Februar, S. 61; Nr. 9/10, 1./8. März, S. 82; Nr. 11/13, 15./29. März, S. 101; Nr. 16/17, 19./26. April, S. 142; Nr. 37/39, 13./27. September, S. 341; Nr. 46/47, 15./22. November, S. 427; Nr. 50/52, 13./27. Dezember, S. 461; Nr. 11/13, 14./28. März 1943, S. 101.
HRENBERG. — Der Springschreiber und sein Einim **Fernschreibnetz** der Deutschen Reichsbahn. 000 Wörter & Abb.)

1942 385. (07 .13 (.43) & 385 .571 (.43)
Der Bahn-Ingenieur, Nr. 14/15, 5./12. April, S. 122.
BURDA (K.). — Die **Ausbildung** der Fachschulpraktikanten maschinentechn. Fachrichtung bei der Deutschen Reichsbahn. (3 600 Wörter & Tafel.)

1942 625 .26 (.43)
Der Bahn-Ingenieur, Nr. 14/15, 5./12. April, S. 132.
GRÜTER. — Wirtschaftliche Ergebnisse im technischen **Betriebswagendienst.** (4 000 Wörter.)

1942 621 .138 .3 (.43) & 621 .138 .5 (.43)
Der Bahn-Ingenieur, Nr. 14/15, 5./12. April, S. 136.
SPÖHRER (K.). — Die **Lokomotivausbesserung** in den Bahnbetriebswerken. (2 600 Wörter.)

1942 621 .138 .5 (.43) & 625 .26 (.43)
Der Bahn-Ingenieur, Nr. 18/19, 3./10. Mai, S. 161.
GITTINGER. — Die **technische Prüfung** im Reichsbahn-Ausbesserungswerk. Ein Mittel zur Leistungssteigerung. (3 800 Wörter.)

1942 388
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ERNICKE (H.). — Die **Massen-Beförderungsmittel** einer Grosstadt. (3 600 Wörter & 2 Tabellen.)

1942 625 .144 .2
Der Bahn-Ingenieur, Nr. 18/19, 3./10. Mai, S. 170.
KERBER. — **Bogenberichtigung** durch rechnerischen Ausgleich der Pfeilhöhen. (500 Wörter & Abb.)

1942 625 .111
Der Bahn-Ingenieur, Nr. 20/21, 17/24. Mai, S. 181.
SPRÖGGEL. — **Landschafts- und Baugestaltung** beim Eisenbahnbau. (5 000 Wörter & Abb.)

1942 656. 212. 5
Der Bahn-Ingenieur, Nr. 22/23, 31. Mai/7. Juni, S. 210.
CAMRATH (W.). — Über **Betriebsverhältnisse am Ablaufberg.** (5 000 Wörter & Abb.)

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1943 621 .335
Elektrische Bahnen, Heft 4/5, April-Mai, S. 65.
KNIFFLER (A.). — Zur Regelung von **Gleichstrom-Triebfahrzeugen.** (4 000 Wörter & Abb.)

1943 621 .332 (.43)
Elektrische Bahnen, Heft 4/5, April-Mai, S. 69.
BLATZ (H.) & SCHNAUFFER (W.). — Erfahrungen mit **Versuchs-Starkstrom-Erdkabeln** bei der Deutschen Reichsbahn. (2 000 Wörter & Abb.)

1943 621 .332
Elektrische Bahnen, Heft 4/5, April-Mai, S. 74.
ZORN (W.). — Das Abtauen von rauhreifbelegten und vereisten **Fahrleitungen.** (8 000 Wörter & Abb.)

1943 621 .332
Elektrische Bahnen, Heft 6/7, Juni-Juli, S. 91.
KILB (E.). — Einfache Berechnung und Darstellung der Spannungsverhältnisse in **Wechselstromfahrleitungsanlagen.** (9 000 Wörter, 2 Tafeln & Abb.)

1943 **621 .332**
Elektrische Bahnen, Heft 6/7, Juni-Juli, S. 102.
KRIENITZ (G.). — **Energieversorgung** elektrisch betriebener Grossbahnen mit höchsten Belastungen. (12 000 Wörter, 8 Zusammenstellungen & Abb.)

1943 **625 .251**
Elektrische Bahnen, Heft 8/9, August-September, S. 119.
HUTT (H.) & GULTZGOF (V.). — Die **Erwärmung der mechanischen Bremsen** von Schienenfahrzeugen. (9 000 Wörter, Tafeln & Abb.)

1943 **621 .13 & 621 .335**
Elektrische Bahnen, Heft 8/9, August-September, S. 133.
ECKHARDT (C. H.). — Betriebseigenschaften und Kenngrössen von **Dampf- und Elektrolokomotiven.** (13 000 Wörter, Tafeln & Abb.)

1943 **621 .335 (.43)**
Elektrische Bahnen, Heft 10/12, Oktober-Dezember, S. 153.
KREUTER & MAIER. — **Regelspurige Abraumlokomotiven** mit 25 t. Achslast. (10 000 Wörter & Abb.)

1943 **621 .332**
Elektrische Bahnen, Heft 10/12, Oktober-Dezember S. 167.
KAMMERER (A.). — Bestimmung der Leitungskonstanten von **Bahnstromfernleitungen.** (4 000 Wörter & Abb.)

1944 **625 .251**
Elektrische Bahnen, Heft 1/2, Januar-Februar, S. 1.
PFLANZ (K.). — **Rad und Schiene als Reibungsgetriebe.** (20 000 Wörter, 2 Zusammenstellungen & Abb.)

1944 **625 .251**
Elektrische Bahnen, Heft 1/2, Januar-Februar, S. 25.
CURTIUS (E. W.) & KNIFFLER (A.). — Neue Erkenntnisse über die **Haftung zwischen Treibrad und Schiene.** (5 000 Wörter & Abb.)

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1942 **385. (09 (.64) & 625 .28 (.64)**
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SCHROETER (H.). — Die **Eisenbahnen Französisch-Marokkos** und ihre **Betriebsmittel.** (2 500 Wörter & Abb.)

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KOCHANKE. — **Luftverdichterregler** in Eisenbahnwerkstätten. (1 000 Wörter & Abb.)

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WACHSMUTH (B.). — Von der **Adhäsion** zur
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KANDAOUROFF (P.). — Die **Eisenbahnen** in F
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gen & Abb.)

Die Lokomotive. (Bielefeld-Berlin.)

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HEISE (G.). — Berechnung der Wärmeübertra
im **Lokomotivkessel.** (1 500 Wörter, 3 Tafeln & Abb.

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Die Lokomotive, Nr. 6, Juni, S. 103.
FARMAKOWSKY (W.). — Dynamische Raddr
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Die ersten **Zahnradbahnen** und das System Rig
bach. (1 300 Wörter & Abb.)

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& Abb.)

1943 **621 .132 .5**
Die Lokomotive, Nr. 7, Juli, S. 129.
2 C + C 2 h 4- Mallet- Eilgüterzug-Lokomotive
M-2, mit 3' 3' T 83 der Western Maryland-Bahn.
Wörter & Abb.)

1943 **621 .335 (**
Die Lokomotive, Nr. 7, Juli, S. 130.
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(1 000 Wörter & Abb.)

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MEYER (E.). — Ankerlose **Lokomotivkessel.**
Wörter & Abb.)

1943 **621 .335 (**
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Die **Triebfahrzeuge** der Furka-Oberalp-Bahn.
Wörter & Abb.)

943 **621 .13 (.73)**
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CHNEIDER (L.). — Der amerikanische **Lokomotiv-** im Jahrzehnt vor dem Kriege. (2 200 Wörter, Zusammenstellungen & Abb.)

943 **621 .91**
Lokomotive, Nr. 9, September, S. 159.
räsen: Mitläufig oder gegenläufig? (4 700 Wörter bb.)

943 **621 .132 .6 (.43)**
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EYER (E.). — **1 D 1 h 2-Güterzug-Tenderlokomotive** reihe 86 Ü K der Deutschen Reichsbahn. (500 Wörter bb.)

943 **621 .132 5 (.73)**
Lokomotive, Nr. 9, September, S. 168.
C + C 3' h 4-Mallet-Lokomotive mit 3' 4' T 95 der sapeake & Ohio-Bahn. (500 Wörter & Abb.)

943 **621 .135 .2 (.43)**
Lokomotive. Nr. 10, Oktober, S. 177.
OHN (W.). **Lokomotiv-Lager** aus Stahlstützschale dünner Auskleidung aus Lagerbronze. (2 000 Wörter bb.)

943 **621 .13 & 621 .431 .72**
Lokomotive, Nr. 10, Oktober, S. 179.
iesel-gegen **Dampflokomotiven.** (800 Wörter.)

943 **621 .132 .3 (.460)**
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D 1-Stromlinien-Lokomotive der Madrid-Zaragoza-ante-Bahn. (250 Wörter & Abb.)

943 **621 .132 .6 (.497 .2)**
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IMMERMANN (W.). — Die **1' F 2'-Drilling-Heiss-pf-Tenderlokomotive,** Reihe 46, der Bulgarischen tsbahnen. (2 000 Wörter, 1 Tafel & Abb.)

943 **621 .133 .7**
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OCH (K.). — Die Ausnutzung der **Vorwärmeranla-** im Betriebe und die dadurch erzielte Kohlenerspar- (2 000 Wörter.)

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942 **621 .131 .1**
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EESEN (F.). — Ein neues Wettrennen der **Lokomo-**. (4 000 Wörter, 2 Tabellen & Abb.)

942 **385. (09 (.59)**
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ERNEKKE (F.). — **British Malaya und seine Eisen-nen.** (4 500 Wörter & Abb.)

942 **656 .212 .6 (.43)**
an für die Fortschritte des Eisenbahnwesens, Heft 8, 15. April, S. 117.
EHRSPAN (K.). — Der Entleerungsvorgang bei **Kohlenentladung.** (2 500 Wörter & Abb.)

1942 **621 .335 (.494) & 656 .226 (.494)**
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Gepäckschnelltriebwagen RFe 4/4 der Schweizerischen Bundesbahnen. (800 Wörter & Abb.)

1942 **621 .135 .4 & 625 .215**
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BÄSELER. — **Fahrzeugführung im Gleis.** (3 000 Wörter.)

1942 **625 .215**
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HEUMANN. — Der **Lauf der Schwenkachsen** in der Geraden. (12 000 Wörter & Abb.)

1942 **385. (01 (.66)**
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WERNEKKE. — Vom **Bau der Mittelmeer-Niger-Eisenbahn** (Sahara-Eisenbahn). (3 500 Wörter & Karte.)

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ROOSEN (R.). — Zur **Frage des Dampflokomotiv-betriebes für die Trans-Sahara-Bahn** « Méditerranée-Niger ». (3 000 Wörter & Abb.)

1942 **621 .131 .1 & 656 .221**
Organ für die Fortschritte des Eisenbahnwesens, Heft 12, 15. Juni, S. 165.
POTTHOFF (G.). — **Anlaufsteigungen.** (7 500 Wörter & Abb.)

1942 **621 .135 .4 & 625 .215**
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HEUMANN. — Zum Einfahren von **Eisenbahnfahrzeugen in Gleisbögen.** (4 000 Wörter & Abb.)

1942 **656 .222 .5**
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GILDEMEISTER (W.). — Zeitwerte für die Arbeitsvorgänge der **Reisezugumbildung.** (3 500 Wörter, 1 Tafel & Abb.)

1942 **656 .222 .1**
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SCHNEIDER (L.). — Fernverkehr mit **Stromlinien-zügen.** (2 000 Wörter, 1 Tafel & Abb.)

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HASSE (F.). — **Durchlassbau im Moorbereich** unter Betriebsgleisen. (1 400 Wörter & Abb.)

1942 **625 .144 .4**
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TÖRÖK (K.). — **Schienenbeförderung** auf Bahnwagen. (1 000 Wörter & Abb.)

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SCHÖNING (P.). — Das **Schlingerproblem an Eisenbahnfahrzeugen.** (30 000 Wörter, Tafeln & Abb.)

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HEUMANN. — **Lauf von zweiachsigen Fahrzeugen** mit losen Rädern eines Radsatzes in der Geraden. (4 500 Wörter & Abb.)

1942 **621 .135 .4 & 625 .215**
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RONAI (J.). — Über die Mechanik der **Aufhängung der Drehgestellwiegen.** (7 000 Wörter & Abb.)

1942 **621 .135 .2, 621 .392 & 625 .212**
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THIEMER (E.). — Die **Radreifen-Spurkranzschweissung** mit einer neuen dreistelligen Lichtbogen-Schweissanlage. (2 500 Wörter & Abb.)

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OSINGA (J. R.) & VAN ZIJP (F. G.). — **Festigkeitsberechnung von Eisenbahnfahrzeugen.** (3 000 Wörter & Abb.)

1942 **625 .143 .1 (.47)**
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SALLER (H.). — Russische **Schienenprofile.** (600 Wörter, 1 Tabelle & Abb.)

1942 **656 .211**
Organ für die Fortschritte des Eisenbahnwesens, Heft 20, 15. Oktober, S. 301.
MÜLLER (W.). — Der **Zugübergangsbahnhof** für Höchstleistung als topologisches Problem. (9 000 Wörter & Abb.)

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SALLER (H.). — Das **Verkehrswesen** der Ukraine. (5 500 Wörter & Karten.)

1942 **624 .2 (.43)**
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WEYGANDT (A.). — Der Einfluss des Strassenverkehrs auf die **Schwingungen von Strassenbrücken** der Reichsautobahn. (7 000 Wörter, Tafeln & Abb.)

1942 **625 .232 (.43)**
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SCHROETER (H.). — 50 Jahre **D-Zugwagen** in Deutschland-50 Jahre D-Zugwagenunterhaltung in Potsdam. (1 200 Wörter & Abb.)

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NOACK (W. G.). — Heutiger Stand des **Veloxkess** (6 000 Wörter & Abb.)

1941 **621 .431 .72 (**
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SCHROETER (H.). — **Triebwagen und Lokomoti mit Verbrennungsmotoren** auf Afrikanischen Kolon bahnen. (3 100 Wörter & Abb.)

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BLEICHER (W.). — Der heutige Stand der **Lei metall-Verwendung im Fahrzeugbau.** (4 500 Wör 2 Zahlentafeln & Abb.)

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KNEULE (F.). — Verkokungsneigung von **Die kraftstoffen.** (2 500 Wörter, 1 Zahlentafel & Abb.)

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RECKEL (F.). — **Gleitschutzregler** für Schienenf zeuge. (800 Wörter & Abb.)

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CORNELIUS (H.) & BOLLENRATH (F.). — **drehwechselfestigkeit von Stahlwellen** mit hoher festigkeit. (3 000 Wörter, 3 Zahlentafeln & Abb.)

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DORGERLOH (E.). — **Schweissnahtrissigkeit.** (1 Wörter.)

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BOCK (E.). — Verhalten von **Beton- und Stahlbe balken** bei Biegeschwingungen. (1 700 Wörter & Abb

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BRÜCKNER (K.). — Schäden an belgischen **Stras brücken mit geschweissten Vierendeelträgern.** (900 W ter & Abb.)

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DIERGARTEN (H.). — **Wälzlagerstähle.** (1 800 W ter, 4 Zahlentafeln & Abb.)

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IUM (A.) & ERKER (A.). — **Zeit- und Dauerfestig-** und deren Beeinflussung durch eine einmalige hohe lastung. (2 000 Wörter, 1 Zahlentafel & Abb.)

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RAUDORN (K. H.). — **Gummi- und gummiähnliche stoffe** als Konstruktionswerkstoff.. (3 000 Wörter, feln & Abb.)

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RISCH (A.). — Der Einfluss der Zusammensetzung **üteter Stähle** auf die Festigkeit und Dauerstandfestig- (1 000 Wörter & Abb.)

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HULZ (H.). — Leistungssteigerung bei der **Gas-telzschweissung.** (2 500 Wörter & Abb.)

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EBL (A.). — **Wiederherstellung einer Eisenbahn-ke.** (1 600 Wörter & Abb.)

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RKER (A.). — **Werkstoffausnutzung** durch festig- gerechtes Konstruieren. (6 000 Wörter & Abb.)

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HWERBER (P.). — **Stahlleichtbau** und Leichtme- Sparbau. (3 500 Wörter & Abb.)

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HÖNHÖFER (R.). — Waagerechte Auflagerung von **lbrücken.** (1 100 Wörter & Abb.)

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RÜCKNER (K.). — **Schwingungen** an amerikani- n **Hängebrücken.** (1 000 Wörter & Abb.)

42 **62. (01 & 669**
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LL (F.) & EGER (W.). — **Streubreite der Brinell-e** bei Gusseisen und Stahl. (3 200 Wörter & Abb.)

42 **621 .132 .8 & 621 .438**
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NTHER (O. A.). — **Gasturbinenlokomotive.** (1 900 ter & Abb.)

1942 **621 .33 (.45)**
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MATERNINI (M.). — Der **elektrische Betrieb** der italienischen Eisenbahnen. (800 Wörter.)

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HEMPEL (M.) & KRUG (H.). — **Dauerfestigkeit und Dehnverhalten von Stählen** in der Wärme. (6 500 Wörter, Tafeln & Abb.)

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1942 **625 .244 (.43)**
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BRUNO NITSCH. — Gefriergutbeförderung in **Kühl-wagen** der Deutschen Reichsbahn. (2 000 Wörter & Abb.)

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Report of Committee 14. — Yards and Terminals. **Freight car repair facilities.** (4 800 words & tables.)

1943 **625 .144 .4 (.73)**
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1943 **625 .235 (.73) & 691 (.73)**
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LEVI (F.). — Graphical solutions of **statistical problems.** (4 500 words, tables & diagrams.)

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VARLEY (R.). — Some aspects of **railway electrification** in Great Britain. (2 400 words.)

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BULLEID (O. V. S.). — **Locomotive engineering** the Chief Mechanical Engineer. (5 000 words.)

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New Southern **locomotives.** (1 500 words.)

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HENDERSON (H. M.). — The strength of **ri** (800 words, tables & fig.)

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946 625 .23 (.42)
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rger capacity Southern suburban stock. **All steel cated coaches** of interesting design. (900 words g.)

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946 656 .211 (.42) & 656 .212 (.42)
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N. E. R. **track layout.** Improvements at Welwyn len City. (800 words & fig.)

946 625 .248 (.42)
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e steam jenny, for **cleaning transport** equipment. words & fig.)

946 625. .23 (.42)
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946 621 .132 .3 (.42)
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arshalling yard layout. A new German example. 00 words.)

946 621 .13 (.42) & 621 .138 .1 (.42)
lern Transport, June 22, p. 3.
rogressive **locomotive policy** of L. M. S. R. Standar-tion in method and design since grouping. (3 600 ds & fig.)

946 385. (09 .3 (.42)
ern Transport, June 22, p. 5
orth British **railway anniversary.** One hundred years he Edinburgh and Berwick line. (1 300 words & fig.)

946 621 .13 (0. (.42)
ern Transport, June 22, p. 3.
rogressive **locomotive policy** of L. M. S. R. (3 200 ds & fig.)

1946 656 .23 (0
Modern Transport, June 29, p. 9.
MARKS (W. G.). — The **need for staggering.** (2 100 words.)

1946 625 .245 (.42)
Modern Transport, June 29, p. 15.
Conveyance of coated roadstone. (450 words & fig.)

1946 621 .132 .1 (.4)
Modern Transport, July 6, p. 9.
New **locomotives** for the Low Countries. Designs for Belgium and Holland. (700 words & fig.)

1946 621 .335 (.931)
Modern Transport, July 6, p. 17.
Electric motor coaches for New Zealand. (300 words & fig.)

1946 621 .431 .72
Modern Transport, July 13, p. 11.
Oil engines for railway traction. Locomotive development by British builders. (1 800 words & fig.)

1946 621 .13 (09 (.42
Modern Transport, July 20, p. 15.
POULTNEY (E. C.). — London and North Western **locomotives, 1846-1923.** (1 200 words & fig.)

1946 621 .431 .72 (.481)
Modern Transport, July 20, p. 16.
Diesel railcar sets for Norway. (600 words & fig.)

1946 656 .283 (.42)
Modern Transport, July 20, p. 19.
A fatal defect in points. Lichtfield **accident report.** (2 300 words & fig.)

1946 625 .13 (.42)
Modern Transport, July 27, p.9.
Bridge renewals on the Southern Railway. (400 words & fig.)

1946 621 .133 .2
Modern Transport, July 27, p. 10.
Improving locomotive efficiency. American methods on L. M. S. R. (1 300 words & fig.)

1946 625 .143 .1 (.42)
Modern Transport, July 27, p. 20.
Flat bottom rails and elastic spikes. (300 words & fig.)

The Oil Engine. (London.)

1946 621 .431 .72 (.42)
The Oil Engine, September, p. 144.
Enlarged **Diesel locomotive range.** (900 words & fig.)

Railway Age. (New York.)

1946 621 .138 .5 (.73)
Railway Age, August 10, p. 218.
Another **modern shop for Diesels.** (3 200 words & fig.)

1946 **621 .431 .72 (.725)**
Railway Age, August 10, p. 226.
Diesel freight power for Mexican line. (2 100 words & fig.)

1946 **656 .283 (.73)**
Railway Age, August 10, p. 236.
Disregard of signals held **collision** cause. (1 900 words.)

1946 **656 .281 (.73)**
Railway Age, August 10, p. 243.
Accident caused by excessive speed on curve. (900 words.)

1946 **625 .111 (.73)**
Railway Age, August 17, p. 281.
Frisco Line **changes** improve operation. (3 000 words & fig.)

1946 **621 .431 .72 (.73) & 725 .33 (.73)**
Railway Age, August 24, p. 332.
MARTIN (G. E.). — Can't neglect **Diesel water facilities.** (2 800 words & fig.)

1946 **621 .131 .1 (.73)**
Railway Age, August 24, p. 335.
POND (C. E.). — **Modern power** on the Norfolk & Western. (1 800 words & fig.)

1946 **656 .254 (.73)**
Railway Age, August 24, p. 340.
C. T. C. saves train time on the C. & O. (1 400 words & fig.)

1946 **691 (.73) & 725 .33 (.73)**
Railway Age, August 31, p. 362.
Engine house gets **aluminum roof trusses.** (1 100 words & fig.)

1946 **656 .254 (.73)**
Railway Age, August 31, p. 364.
Loud-speaker yard communication. (1 800 words & fig.)

1946 **621 .431 .72 (.73)**
Railway Age, August 31, p. 367.
Diesels aid the Rio Grande. (2 000 words & fig.)

1946 **621 .431 .72 (.73)**
Railway Age, August 31, p. 371.
E. J. & E. receives **transfer locomotive.** (1 800 words & fig.)

1946 **656 .254 (.73)**
Railway Age, August 31, p. 373.
Radio in railroad tunnels. (700 words.)

1946 **625 .243 (.73)**
Railway Age, August 31, p. 373.
Auto-loader for light cars designed. (300 words & fig.)

Railway Engineering and Maintenance. (Chicago.)

1943 **625 .154 (.73)**
Railway Engineering and Maintenance, January, p. 46.
Old **turntables** get new lease on life. (2 100 words & fig.)

1943 **656 .253 (**
Railway Engineering and Maintenance, February, p.
How Missouri Pacific developed **reflex signs.** (1 words & fig.)

1943 **625 .14**
Railway Engineering and Maintenance, April, p. 29
Applying **joint bars** to rail. (1 400 words & fig.)

1943 **625 .144 .4 (**
Railway Engineering and Maintenance, May, p. 359
Tie saws-speed up **renewal work.** (2 400 words & f

1943 **625 .143 .3 (.73) & 625 .172 (**
Railway Engineering and Maintenance, May, p. 368
Uses **mirrors** to detect **failed rails.** (2 200 words.)

1943 **625 .13 (**
Railway Engineering and Maintenance, June, p. 440
D. & H. lowers rock floor 2 ft. in 2 240-ft. **tur** (3 500 words & fig.)

1943 **625 .141 (.73) & 625 .144 .4 (**
Railway Engineering and Maintenance, June, p. 447
Erie uses mechanical **ballast shapers.** (3 200 w & fig.)

1943 **625 .141 (**
Railway Engineering and Maintenance, August, p.
Adapting **ballasting** methods to to-day's probl (3 600 words & fig.)

1943 **625 .143 .3 (.73) & 625 .144 .4 (**
Railway Engineering and Maintenance, August, p.
Southern Pacific **cold-straightens the drop out of ends.** (2 500 words & fig.)

1943 **625 .143 .1 (**
Railway Engineering and Maintenance, October, p.
Burlington tests **rail of new design.** (1 300 words &

1943 **625 .152 (**
Railway Engineering and Maintenance, November, p.
Installs **timber foundation under heavy-duty cros** (800 words & fig.)

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1946 **656. 285 (**
Railway Gazette, No. 23, June 7, p. 630.
Ministry of War Transport accident report. Lich L. M. S .R., January 1, 1946. (3 800 words & fig.)

1946 **625 .244 (**
Railway Gazette, No. 24, June 14, p. 650.
Design, construction and operation of railway **re rated wagons.** (1 800 words.)

1946 **625 .233 (.42) & 656 .215**
Railway Gazette, No. 24, June 14, p .651.
Fluorescent lighting developments. (1 100 words &

)46 **623 (.493) & 624 (.493)**
ailway Gazette, No. 24, June 14, p. 655.
EMAIRE (C. F. B.). — **War-damaged bridges** in ium. (1 100 words & fig.)

)46 **621 .132 .3 (.42)**
way Gazette, No. 24, June 14, p. 658.
Major-General Mc Mullen » British-built **2-8-0 Auste- locomotive** on Longmoor Military Railway. (500 ls & fig.)

)46 **621 .110**
way Gazette, No. 25, June 21, p. 684.
new brake testing machine. (900 words & fig.)

)46 **621 .132 .3 (.4) & 621 .132 .5 (.4)**
way Gazette, No. 26, June 28, p. 708.
ne « **Liberation** » **2-8-0 type locomotive** with double- e tender for european use. (4 000 words & fig.)

)46 **313 : 385 (.41)**
way Gazette, No. 1, July 5, p. 10.
nancial and operating statistics of railway companies reland. (2 200 words.)

)46 **621 .94**
way Gazette, No. 1, July 5, p. 20.
new hexagon **turret lathe.** (1 800 words & fig.)

)46 **656 .285 (.42)**
way Gazette, No. 1, July 5, p. 26.
inistry of Transport **accident report.** Nottingham, hern Railway, March 19, 1946. (1 000 words.)

)46 **621 .335 (.436)**
way Gazette, No. 3, July 19, p. 67.
rvice tests of **electric locomotives.** (1 700 words g.)

)46 **621 .335 (.931)**
way Gazette, No. 3, July 19, p. 69.
nglish **Electric motor coaches** for New Zealand. (300 ls & fig.)

946 **621 .132 .3 (.42)**
way Gazette, No. 4, July 26, p. 95.
ne new L. N. E .R. class « A 2 » **Pacific locomotive.**) words & fig.)

946 **656 .215 (.42)**
way Gazette, No. 4, July 26, p. 96.
ondon Transport station lighting. (600 words & fig.)

946 **656 .285 (.42)**
way Gazette, No. 4, July 26, p. 104.
inistry of Transport **accident report.** Near North- d. Met. & G. C. Joint Railway, December 31, 5. (4 800 words.)

946 **625 .245 (.73)**
way Gazette, No. 5, August 2, p. 123.
ew aluminium **triple-hopper wagon.** (900 words ig.)

946 **621 .132 .5 (.73)**
way Gazette, No. 5, August 2, p. 126.
hay **geared locomotive** for Western Maryland Rail- d. (1 000 words & fig.)

1946 **625 .13 (.42)**
Railway Gazette, No. 5, August 2, p. 128.
Southern Railway **bridge reconstruction.** Renewals at Blackfriars and Camberwell. (400 words & fig.)

1946 **385. (075 (.42)**
Railway Gazette, No. 5, August 2, p. 129.
L. N. E. R. **engineering department manuals.** (800 words & fig.)

1946 **625 .241 (56 .7)**
Railway Gazette, No. 6, August 9, p. 150.
Heavy standard-gauge locomotives carried on metre gauge. (1 500 words & fig.)

1946 **656 .253 (.42)**
Railway Gazette, No. 6, August 9, p. 154.
New signals at Reading West, G. W. R. (140 words & fig.)

1946 **624 .32 (.73)**
Railway Gazette, No. 6, August 9, p. 158.
New Saginaw **river bridge,** U. S. A. (800 words & fig.)

1946 **656 .283 (.42)**
Railway Gazette, No. 6, August 9, p. 161.
Buffer-stop collision at Edgware, L. P. T. B. (350 words.)

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1946 **656 .222 .1 (.42)**
Railway Magazine, No. 566, Nov.-Dec., p. 341.
ALLEN (C. J.). — British **locomotive practice and performance.** (3 500 words.)

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1943 **621 .131 .1**
Railway Mechanical Engineer, May, p. 201.
FRY (L. H.). — **Locomotive machine friction.** (1 400 words, tables & fig.)

1943 **621 .13 & 621 .431 .72**
Railway Mechanical Engineer, May, p. 204.
SILLCOX (L. K.). — **Diesel** or **steam power?** (3 500 words, tables & fig.)

1946 **625 .245 (.73)**
Railway Mechanical Engineer, February, p. 62.
Aluminium 70-ton hopper cars. (1 000 words & fig.)

1946 **625 .245 (.73)**
Railway Mechanical Engineer, February, p. 68.
Great Northern 50-ton drop-bottom gondolas. (1 500 words & fig.)

1946 **625 .236 (.73)**
Railway Mechanical Engineer, February, p. 90.
HANFT (H. H.). — **Passenger car auxiliaries.** (2 200 words & fig.)

1946 **625 .233 (.73)**
Railway Mechanical Engineer, February, p. 93.
Light for passenger cars. (800 words & fig.)

1946 **625 .23 (.73)**
Railway Mechanical Engineer, March, p. 111.
Design considerations for passenger cars. (4 000 words.)

1946 **621 .431 .72 (.73)**
Railway Mechanical Engineer, March, p. 117.
WILES (G. H.). — The maintenance and operation of **Diesel electric locomotives.** (4 800 words.)

1946 **625 .26 (.73)**
Railway Mechanical Engineer, March, p. 136.
Baltimore & Ohio streamlines its **shops.** (1 300 words & fig.)

1946 **656 .254 (.73)**
Railway Mechanical Engineer, March, p. 142.
PRENDERGAST (L. J.). — **Experience with VHF radio.** (3 500 words & fig.)

1946 **621 .431 .72 (.73) & 656 .212 .5 (.73)**
Railway Mechanical Engineer, March, p. 146.
Diesels for hump pushers. (1 500 words & fig.)

1946 **625 .233 (.73) & 656 .254 (.73)**
Railway Mechanical Engineer, March, p. 149.
KENNEDY (J. J.). — **Power supply for communication equipment.** (1 000 words & fig.)

1946 **621 .13 (.43) & 625 .2 (.43)**
Railway Mechanical Engineer, April, p. 184.
German development of **locomotives and cars.** (2 200 words.)

1946 **621 .132 .4 (.73)**
Railway Mechanical Engineer, April, p. 189.
Reading **T-1 locomotives.** (2 000 words & fig.)

1946 **621 .135 .2 (.73) & 621 .138 .5 (.73)**
Railway Mechanical Engineer, April, p. 204.
HOLSINGER (F.). — **Wheel shop practices.** (2 200 words & fig.)

In Spanish.

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1946 **385 (061 .6**
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NUNEZ BRIAN (J.). — **Congreso Panamericano de Ferrocarriles.** Sus antecedentes. (2 400 palabras.)

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Congreso Panamericano de Ferrocarriles. Conclusiones aprobadas por el V Congreso de Montevideo y cuyo complimento esta a cargo del Comité Ejecutive. (5 000 palabras.)

1946 **385 .113**
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Ferrocarriles Nacionales del Canada. **Resultados explotación** en el ejercicio de 1945. (1 000 palabr cuadros.)

Ferrocarriles y Tranvias. (Madrid.)

1943
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El **desarrollo de la aviación comercial** y sus po efectos sobre el ferrocarril. (3 000 palabras & fig.)

1943 **624**
Ferrocarriles y Tranvías, octubre, p. 273.
POHL (B.). — La construcción de **puentes** en los carriles alemanes. (8 000 palabras & fig.)

1943 **621 .1**
Ferrocarriles y Tranvías, noviembre, p. 298.
DE VELASCO (R. M.). — Las características **locomotora « Santafé ».** (1 600 palabras & fig.)

1943
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CABRERA (J. B.). — **El turismo y el ferroc** (2 000 palabras.)

1943 **385 .588**
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Las **Asociaciones profesionales del personal** Sociedad de los Ferrocarriles Franceses. (2 500 palab

1943 **656**
Ferrocarriles y Tranvías, diciembre, p. 324.
SANDOVAL CAMPDERA (J. M.). — Import del **factor tiempo** en la Economía ferroviaria. (5 400 bras & fig.)

1943 **656 .261**
Ferrocarriles y Tranvías, diciembre, p. 340.
Distribución, por medio de tranvías, de paquetes portados por ferrocarril. (1 600 palabras.)

1944 **621 .133 .1 (**
Ferrocarriles y Tranvías, enero, p. 4.
MALDONADO (M. J.). — El **consumo de carb** la RENFE. (3 000 palabras.)

1944 **625 .14 (**
Ferrocarriles y Tranvías, enero, p. 13.
MONEVA (F.). — Nuevo **sistema de vía** aplica las lineas ferroviarias españoles de gran trafico. palabras & fig.)

In Italian.

Ingegneria ferroviaria (Roma.)

1946 **62**
Ingegneria ferroviaria, ottobre, p. 89.
MARTINI (D.). — Le **gallerie parietali.** (3 000 p tabelle & fig.)

46 625 .212
neria ferroviaria, ottobre, p. 104.
ANCHEDI (R.). — Gli **assi dei veicoli ferroviari** i. (5 000 parole & fig.)

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sta tecnica delle ferrovie italiane. (Roma.)

42 624 .63 (.45)
ta tecnica delle ferrovie italiane, 15 agosto, p. 253.
LSONI (G.). — Un grande **viadotto ferroviario in nto armato** a travate continue con portata di m. 32. 0 parole & fig.)

42 385 .574
ta tecnica delle ferrovie italiane, 15 agosto, p. 256.
NELLI (A.). — Contributo delle indagini psicoiche alla **selezione del personale di condotta dei i di trazione.** (9 000 parole & 3 tavole.)

42 385. (09 (.496 + .56)
ta tecnica delle ferrovie italiane, 15 agosto, p. 271.
BBA (F.). — Le **ferrovie della Turchia** e le relazioni ee con il Medio Oriente. (8 000 parole & fig.)

42 62. (01 & 669
ta tecnica delle ferrovie italiane, 15 settembre, . 301.
NNAVAJA (S.). — L'**analisi spettrale delle leghe liche.** (10 000 parole & fig.)

42 625 .245 (.45)
ta tecnica delle ferrovie italiane, 15 ottobre, p. 321.
L GUERRA (G.). — **Carri speciali** da tonnellate 120 ortata con struttura portante a culla e traverse abili. (4 000 parole & fig.)

42 656 .256 (.45)
ta tecnica delle ferrovie italiane, 15 ottobre, p. 328.
GET (C.). — I **circuiti elettrici degli impianti di zza** ferroviari. (10 000 parole & fig.)

42 621 .33 (.45) & 621 .336 (.45)
ta tecnica delle ferrovie italiane, 15 novembre, . 357.
NATI (F.). & DE NICOLA (P.). — **Economia di sulle condutture di contatto** a corrente continua. **rificazione** della Roma-Frascati. (3 000 parole & fig.)

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ta tecnica delle ferrovie italiane, 15 novembre, . 365.
NOFFI (U.). — L'**usura ondulatoria delle rotaie.** e provvedimenti delle Tranvie di Torino. (1 500 e, 2 tabelle & fig.)

42 621 .133 .7
ta tecnica delle ferrovie italiane, 15 dicembre, . 389.
CHELUCCI (A.). — Ejettore per colonne idrau- Apparechio che realizza la **depurazione chimica cqua nell'interno delle caldaie** delle locomotive con issione di un reagente. (1 600 parole & fig.)

42 656 .256 .3 (.45)
ta tecnica delle ferrovie italiane, 15 dicembre, . 393.
RACUZZI (A.). — Gli **impianti di segnalamento** ferrovia Biella-Novara. (6 000 parole & fig.)

In Dutch.

Spoor- en Tramwegen. (Utrecht.)

1943 **385**
Spoor- en Tramwegen, Nr 11, 22 Mei, p. 163; Nr 12, 5 Juni, p. 181.
TISSOT VAN PATOT (J. P. B.). — **Toekomstproblemen.** (7 500 woorden.)

1943 **625 .174**
Spoor- en Tramwegen, Nr. 11, 22 Mei, p. 167.
BOEZAARDT (J. P.). — Toestel voor het **verwijderen van ingedrongen jachtsneeuw** uit electrische treinstellen. (800 woorden & fig.)

1943 **385. (09 (.92)**
Spoor- en Tramwegen, Nr 13, 19 Juni, p. 195; Nr 15, 17 Juli, p. 232; Nr 17, 14 Augustus, p. 263; Nr 18, 28 Augustus, p. 279; Nr 19, 11 September, p. 291; Nr 20, 25 September, p. 304; Nr 21, 9 October, p. 318; Nr 22, 23 October, p. 332.
REITSMA (S. A.). — De **Staatsspoorweg ter Sumatra's Westkust.** (S. S. S.) (28 000 woorden & fig.)

1943 **621 .13 (09 (.492)**
Spoor- en Tramwegen, Nr. 17, 14 Augustus, p. 259; Nr 18, 28 Augustus, p. 276; Nr 19, 11 September, p. 288.
LABRIJN (P.). — De **SS-snelltreinlocomotieven** van 1880-1910. (4 700 woorden, tabellen & fig.)

1943 **656**
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DE BRUIN (G.). — **Vervoerspolitiek in oorlogstijd.** (2 500 woorden.)

1943 **656 .256**
Spoor- en Tramwegen, Nr 20, 25 September, p. 301.
VERSTEGEN (J. H.). — Over de minimum **bloklengte.** (1 000 woorden & fig.) (Zie ook Nr 10, 6 Mei 1944, p. 117.)

1943 **625. 232 (.43)**
Spoor- en Tramwegen, Nr 21, 9 October, p. 322.
Een ontwerp voor **tweeverdiepings-vierwagenstellen** von D- en sneltreinen. (1 200 woorden & 3 tabellen.)

1943 **351 .811 (.492) & 656 .1 (.492)**
Spoor- en Tramwegen, Nr 22, 23 October, p. 329.
HAGEN (A. J.). — Voorrang bij **tram- en autoverkeer.** (3 000 woorden.)

1943 **656 .225 (.492)**
Spoor- en Tramwegen, Nr 23, 6 November, p. 345.
BOOGAARD (C.). — Het kompas, waarop **goederen** hun weg vinden bij vervoer per spoor. (5 000 woorden.)

1943 **656 .273**
Spoor- en Tramwegen, Nr 24, 20 November, p. 362.
VAN WIJK (H. P. D.). — Zonder **vaste seinen.** (3 600 woorden & fig.)

1943 **385 (.3)**
Spoor- en Tramwegen, Nr 25, 4 December, p. 373.
SLOTHOUWER (J. F. A.). — De **geographie van de spoorwegen.** (5 000 woorden & fig.)

1943 **621 .33 (.485)**
Spoor- en Tramwegen, Nr 25, 4 December, p. 383.
De **electrificatie** in Zweden. (400 woorden.)

1943 **656 .211 (.492)**
Spoor- en Tramwegen, Nr 26, 18 December, p. 387.
BARDET (J. D. M.). — Een eeuw **Spoorwegen in Utrecht** (1843 — 28 December 1943). (7 000 woorden & fig.)

1944 **625 .232 (.492)**
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KARSKENS (J. J.). — **Rijtuigen met restauratie.** (1 000 woorden & fig.)

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REITSMA (S. A.). — De indirecte baten en de **rentabiliteit bij het vervoer.** (8 000 woorden.)

1944 **625 .232 (.460)**
Spoor- en Tramwegen, Nr 3, 29 Januari, p. 29.
HUG (Ad. M.). — Een **uiterst lichte Spaansche motortrein.** (1 500 woorden & fig.)

In Portuguese.

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1946 **385. (09 (**
Gazeta dos Caminhos de ferro, nº 1412, 16 de out
p. 683.
VIEIRA DE CASTRO (A.). — Da **restauraç modernização** dos Caminhos de ferro Portugueses (1946). (1 200 palavras.)

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p. 699.
VIEIRA DE CASTRO (A.). — **Electrificações e i trializações.** (1 200 palavras.)

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Revista das Estradas de ferro, 15 de agosto, p. 44
BRIERS (J.). — Gigantesco **plano de const ferroviária.** A Australia planeja padronisar 33 000 has de estradas e modernisar o material rodante dos maiores projetos de engenharia do mundo. palavras & mapa.)

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